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Experiments With Legumes at the Northeast Louisiana Experiment Station

By
C. B. HADDON



LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
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By C. B. HADDON*

The fact that growing leguminous plants will improve the productive capacity of soils has been known many centuries. Actually the practice is as old as agriculture itself. Reference to it and suggestions as to its development and use are made in the writings of the ancient Greeks before 400 B.C. Many plantations in the South prior to the War Between the States planted cowpeas or some legume plant at least once every three years on cotton land.

The value of growing a winter legume and turning it under prior to planting cotton has been known and to a limited extent the concept has been put into practice in the South for many years. Possibly the main reason this practice was not generally adopted earlier was the lack of equipment for turning under the growth. This writer vividly remembers trying to turn under a heavy growth of Hairy vetch more than 50 years ago, using a small, one-mule turning plow on a heavy growth of the legume which had not been previously disked. The result was not very encouraging for a continuation of the practice. With the advent of power equipment, such as farm tractors, heavy disks, turning plows, and middle busters, the practice of growing winter legumes became more general. However, it was not until the enactment of the Agricultural Conservation Act in 1936 under which farmers were paid for adopting the practice that it became almost universal throughout the South.

WINTER LEGUMES

Work with winter legumes was started at the Northeast Louisiana Experiment Station, St. Joseph, La., in 1929, the year the Station was established. In the fall of that year a series of plots were laid out for this work. Ten plots were planted to different winter legumes; one plot was used as a check and received no treatment; and one plot received 24 pounds of available nitrogen instead of the winter legume. These plots have been used for this purpose continuously since that date. The test was laid out on good quality, sandy loam alluvial soil which had produced approximately a bale of cotton per acre without fertilizer or legumes. The check plot which has never been planted to any legume nor received any fertilizer has steadily decreased in yield until it is now producing less than one-half bale of cotton per acre. The plot receiving nitrogen has just about maintained the production it had in 1929. The plots planted to winter legumes have never had any fertilizer appli-

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cation and have maintained a production of approximately one and one-half bales of cotton per acre. During the years since the beginning of this work every variety of vetch, winter peas, and clover obtainable has been tried for adaptability, winter hardiness, gross yield, and freedom from disease.

In Tables 1, 2 and 3 which give results of work with winter legumes, yield of green weight of each is compared to that of Hairy vetch, since this variety is widely grown in the South. Any winter legume grown a few years in the test is compared to Hairy vetch for the same years. Similarly, the yield of cotton following any winter legume used is compared to the yield of the check plot for the same years. The legume crops are usually planted in the old cotton stalks about the middle of October and turned under about March 25 to April 2. Cotton is planted about three weeks after turning under the cover crop.

TABLE 1. Vetches

Variety	Yield green wt., lbs. per acre	Per cent Hairy vetch	Yield cotton, lbs. per acre	Yield check, lbs. per acre	Years tested
24 lbs. nitrogen	-----	-----	1386	876	22
Hairy	16,473	-----	2071	913	18
Common	12,082	73	1783	877	20
Common 02830	11,330	76	1213	668	2
Common (Austria)	17,624	101	1865	749	4
Common 29933	10,011	81	1965	835	6
Common 18818	11,605	89	1786	784	4
Common 16462	6,325	49	1582	784	4
Monantha	25,482	119	1889	968	8
Hungarian	17,434	93	1854	925	11
Hungarian (Imp.)	9,708	58	-----	-----	1
Hungarian 103977	9,863	54	1649	883	2
Purple	13,858	91	1751	925	6
Woolypod	17,481	153	1978	838	15
Wild	13,482	82	1552	799	2
Willamette	7,870	68	1871	848	8
Alber	9,775	79	2006	933	4
Black	7,543	70	1665	789	2
Smooth	18,067	101	1954	925	13
Doark	7,402	48	2166	823	2
Lebanon	11,867	73	1835	651	2

TABLE 2. Clovers

Variety	Yield green wt., lbs. per acre	Per cent Hairy vetch	Yield cotton, lbs. per acre	Yield check, lbs. per acre	Years tested
California bur	11,714	40.1	1792	1060	3
Melilotus alba	1,375	4.7	1417	1060	3
Melilotus indica	8,067	41.9	1430	928	8
Southern bur	14,894	86.1	2020	998	6
Persian	12,671	60.6	1885	1133	2
Giant bur	13,464	104.9	1652	862	6
Manganese	13,358	99.7	1121	863	2
Reseeding crimson	24,392	150.7	1977	661	2
Common crimson	21,654	112.2	2116	625	2
Red	10,693	43.6	1868	992	4

TABLE 3. Winter Peas

Variety	Yield green wt., lbs. per acre	Per cent Hairy vetch	Yield cotton, lbs. per acre	Yield check, lbs. per acre	Years tested
Austrian Winter	13,907	81.6	1689	879	15
Tangier	15,331	102.1	1777	920	7
Southern Winter (<i>Lathyrus hirsutus</i>)	9,242	77.5	1907	808	12
Southern Winter (Scarified seed)	12,625	93.6	1939	749	7
Creole	1,935	25.1	1476	913	3
Dixie Wonder	6,810	59.0	1673	843	4
Canada Field	Failure				
Idaho White	Failure				

A study of Table 1 will show that Hairy, Common, Common 29933, Monantha, Hungarian, Purple, Woollypod, and Smooth vetches were in test six years or longer and produced an average of more than five tons of green matter to be turned under. Of this group some varieties cannot be recommended for various reasons. Woollypod, in test 15 years, made excellent growth, was sufficiently winter hardy for this latitude, and was relatively free from disease, but inability to obtain seed eliminates it from the recommended list. If seed were available, this variety would be highly recommended. Monantha, though lacking some in winter hardiness, produced excellent growth the eight years it was in test. Seed of this variety is not usually found on the general market. Smooth vetch, in test 13 years, was very similar to Hairy in earliness of growth, total tonnage, freedom from disease, and winter hardiness. This variety would also be high on the recommended list if seed were available. Common vetch has been in test longer than any other variety, 20 years, and for the first 12 or 15 years ranked high in all desirable features. During the last five years of test, however, yields have been somewhat low owing to various diseases. Hungarian, in test 11 years, though lacking some in winter hardiness made good yields in the early period of test, but during the latter years became seriously affected by various diseases, which caused it to be eliminated. Some of the other vetches in test two or more years showed considerable promise but because of various factors cannot be recommended.

Table 2 shows that practically all of the clovers, while not tested as long as some of the vetches, made good yields, ranging from 5 to 12 tons green weight. *Melilotus indica*, in test eight years, is not sufficiently winter hardy to be recommended for the latitude of this Station. California bur, Southern bur, Giant bur, and Manganese all made good yields in the early years of testing but gradually decreased in total growth during the later years because of diseases. All of these could be recommended for general use for four to six years on the same land. Red clover is somewhat too late in making a heavy growth to be recommended as a cover crop to be followed by cotton. In mild winters sufficient tonnage is produced by April 1, the usual date for turning under,

but in severe winters growth is rather small on the turning-under date. Crimson clover, both reseeding and common strains, has been in test two years and shows considerable promise. Growth has been sufficient to produce large tonnage by April 1, no winter kill has been observed, and no disease is apparent. Further testing, however, will be necessary before general recommendation can be made.

Table 3, Winter Peas, shows that Austrian Winter, Tangier, and Southern Winter have produced sufficient green weight by April 1 to put them on the recommended list. However, the lack of seed of Tangier eliminates this variety. Austrian Winter peas, like common vetch, made excellent growth during the early years in test but, owing to various diseases, made somewhat poorer yields in later years. Southern Winter pea (*Lathyrus hirsutus*), variously known as Singletary, Caley, or Wild Winter pea, has been in test 12 years and, while somewhat later in growth than desired, has been fairly satisfactory as a winter cover crop. As shown by the table, the planting of scarified seed of this pea gives a much better yield of green matter because of higher and quicker germination. As seen in the table, the use of scarified seed has brought the yield of this legume up to 93.6 per cent of Hairy vetch during the seven years of testing. Lupines were also tried and were found to lack winter hardiness.

Date of Turning Vetch

A test was conducted over a period of eight years to determine the best date for turning under vetch when followed by cotton. Common vetch was used in this test, seeded at the rate of 32 pounds per acre and planted about the middle of October. Cotton was planted as near the first of May as possible. A check plot was used which had no vetch planted on it, and another plot without vetch received 24 pounds of nitrogen. Results of this test are shown in Table 4.

TABLE 4. Date of Turning Vetch

Date turned	Yield green wt., lbs. per acre	Yield cotton, lbs. per acre	Increase over 24 lbs. N	Increase over check
Check		1345		
24 lbs. N		1809		464
March 15	5,780	2019	210	674
April 1	12,614	2176	367	831
April 15	15,144	2121	312	776

Results show that the vetch did not make maximum growth by March 15, although sufficient growth was made to give a profitable increase in the yield of cotton. By April 1 the vetch averaged more than six tons of green matter and turning under on this date gave the best yield of cotton. By April 15 there was some increase in yield of green matter, but there was not sufficient decay by May 1 to plant cotton. The lack of decay from the April 15 turning under caused considerable difficulty in planting and in some years seriously affected the stand of

cotton. Based on the results of this test, it is recommended that vetch should be permitted to make almost maximum growth, when possible, but it should be turned under at least three weeks before cotton is planted. However, seasons will determine the length of time to wait. If sufficient rainfall is obtained after turning under to settle the soil on the vetch and supply sufficient moisture for hastening decay, cotton may be planted sooner than if dry weather prevails.

Rate of Seeding Vetch

In order to determine the most profitable rate of seeding vetch, a test was conducted for six years using rates of 15 to 40 pounds per acre with 5-pound increments. Oregon-grown Common vetch was used in this test, planted about October 15 and turned under as near April 1 as possible. Results are given in Table 5. While good results were obtained from use of the lighter rates of seeding, it is considered a better farming practice to use a rate of not less than 30 pounds per acre. By using the heavier rates of seeding, the vetch may be turned under 10 to 15 days earlier, which is very important since it is highly desirable that the vetch be fairly well rotted before planting cotton.

TABLE 5. Rate of Seeding Vetch

Rate	Yield green wt., lbs. per acre	Yield cotton, lbs. per acre	Increase over 24 lbs. N	Increase over check
Check		1106		
24 lbs. N		1546		440
15 lbs. per acre	11,497	2014	468	908
20 lbs. per acre	12,979	2096	550	990
25 lbs. per acre	14,184	2132	586	1026
30 lbs. per acre	14,886	2148	602	1042
35 lbs. per acre	15,353	2208	662	1102
40 lbs. per acre	15,959	2222	676	1116

Residual Effects of Winter Legumes

In order to determine the residual effect of growing winter legumes a series of plots which had had various legumes followed by cotton for three years were planted to cotton two successive years without legumes. A check plot which had not been planted to legumes and a plot receiving 24 pounds of nitrogen without legumes were included in the test. The nitrogen was applied each year in which the residual effects were studied. The results are given in Tables 6 and 7.

The first year of this study was a good cotton year, while the second year was very unfavorable. The yields of the various legumes during the three years they were planted averaged more than six tons green weight per acre. The tables show that very profitable increases in yield were obtained, even in the second year after the legumes had been grown.

Table 6 shows that better yields of cotton were obtained from the residual effects of the legumes than from the application of 24 pounds of nitrogen. Table 7 shows that the use of 24 pounds of nitrogen pro-

TABLE 6. Second Cotton Crop Following Winter Cover Crops

Cover crop	Yield cotton, lbs. per acre	Increase over check, lbs. per acre
Check	1128	-----
150 lbs. nitrate of soda	1366	238
Austrian Winter pea	1523	395
Oregon Hairy vetch	1563	435
Monantha vetch	1531	403
Oregon Common vetch	1691	563
Hungarian vetch	1612	484
Southern bur clover	1551	423
Red clover	1345	217
Crimson clover	1232	104
Abruzzi rye	953	-175

TABLE 7. Third Cotton Crop Following Winter Cover Crop

Cover crop	Yield cotton, lbs. per acre	Increase over check, lbs. per acre
Check	516	-----
150 lbs. nitrate of soda	1038	522
Austrian Winter pea	855	339
Oregon Hairy vetch	992	476
Monantha vetch	879	363
Oregon Common vetch	944	428
Hungarian vetch	968	452
Southern bur clover	858	342
Red clover	745	229
Rye	481	- 35

duced better yield of cotton than did the second year residual effect of the winter legumes.

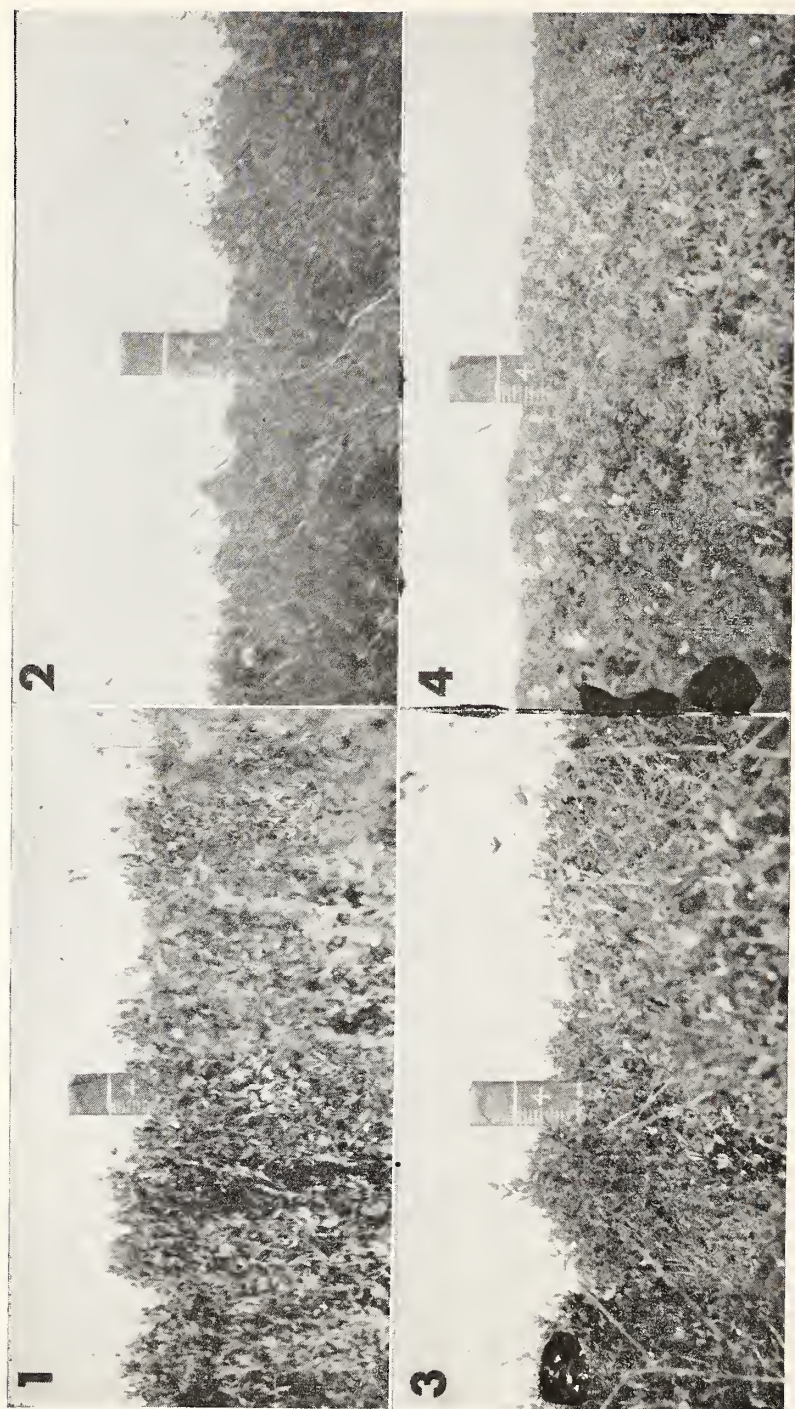
Commercial Nitrogen as Supplement to Vetch

Is it profitable to apply additional nitrogen when a good growth of winter legume is turned under to be followed by cotton? If so, how much nitrogen and from what source? In order to answer these questions a test was conducted for six years. Common vetch was used and good growth was obtained, averaging five to seven tons per acre at the time of turning under. Nitrogen from four sources at two rates of application, applied at the time the vetch was turned under, was used. The results of this test are given in Table 8.

A study of the table shows that a slight but profitable increase in yield of cotton was obtained. Evidently the benefit from the added nitro-

TABLE 8. Commercial Nitrogen as a Supplement to Vetch

Item	15 lbs. N	Increase over vetch	30 lbs. N	Increase over vetch
Vetch alone	1877	-----	1877	-----
Vetch & nitrate of soda	1989	112	2025	148
Vetch & ammonium nitrate	1938	61	2046	169
Vetch & ammonium sulphate	2021	144	2068	191
Vetch & cyanamid	1933	56	2056	179



Growth of some of the winter legumes used in experiments at the Northeast Louisiana Experiment Station. No. 1, Southern Winter peas growing on old cotton stalks; No. 2, Italian Common vetch on old cotton stalks; No. 3, Hairy vetch on old cotton stalks; No. 4, blue lupine (mild winter).

gen was due to the fact that the young cotton had available nitrogen for early stage of growth while the organic nitrogen derived from the vetch was in process of becoming available. This conclusion is borne out by the results obtained from a similar test where the nitrogen was applied as a side-dressing when the cotton was four to six inches high. On this latter test no consistent increase in yield was obtained. Based on the results of this work it is concluded that if nitrogen is to be added to supplement the benefits of a winter cover crop it should be applied at the time the cover crop is turned under.

Nitrogen Plus the Residual Effect of Vetch

A test was conducted for three years to determine the amount of nitrogen plus residual effect of vetch that would be comparable to growing vetch annually. Common vetch was used in this test and nitrogen from four sources at rates of 22½ pounds and 45 pounds available nitrogen per acre. The check plot had vetch the preceding year but none the year of the test. One plot had vetch annually. The plots receiving fertilizers had had vetch the preceding year but none the year the fertilizer was used. The results are given in Table 9.

TABLE 9. Nitrogen Plus Residual Effect of Vetch

Item	Yield cotton, lbs. per acre			
	22½ lbs. nitrogen	Increase over check	45 lbs. nitrogen	Increase over check
Check	1342	-----	1342	-----
Vetch	1788	446	1788	446
Nitrate of soda	1734	392	1967	625
Ammonium nitrate	1657	315	2000	658
Ammonium sulphate	1721	379	1995	653
Cyanamid	1588	246	1903	561

It may be seen from this table that the use of 22½ pounds of nitrogen plus the residual effect of a crop of vetch turned under the year before was not quite equal to turning under vetch annually, though the difference is not significant. The application of 45 pounds of nitrogen plus residual effect of vetch gave considerably higher yields than did the turning under of vetch annually. The results indicate that good yields of cotton may be maintained either by growing vetch each year or by growing vetch in alternate years with nitrogen used the year vetch is not grown. Since it is not advisable for the farmer to plant all of his cotton acreage to vetch, because of seasonal conditions which might prevent turning under in time for cotton, the use of the method indicated in the above test would be profitable.

Date of Planting Vetch

A test was conducted for two years to determine the best date for planting vetch to be followed by cotton. The first planting was made at the last cultivation of the cotton, which is usually the first week in

August. Other plantings followed September 1, October 1, and November 1. The last three plantings were made by sowing the vetch broadcast and running a middle buster in the cotton middles. The results are given in Table 10.

TABLE 10. Date of Planting Vetch

Date planted	Yield green wt., lbs. per acre
At last cultivation of cotton	7,710
September 1	15,943
October 1	23,392
November 1	21,693

While good growth was obtained from each date of planting, except the earliest, this method is not considered practical. Considerable injury to the cotton resulted from running the middles out, especially with the September 1 and October 1 plantings. Vetch planted at the last cultivation of cotton and September 1 was considerably damaged by trampling and dragging of cotton sacks on it when cotton was picked. This damage would not be as severe where mechanical picker is used.

Depth of Planting Vetch or Winter Peas

Seed of vetch or Winter peas will come up from depths ranging from barely covered to six or more inches. The following data from Louisiana Bulletin No. 375 by Brown, Johns, and Haddon give information on the percentage of emergence of Common vetch at Baton Rouge, Calhoun, and St. Joseph. The experiments at Baton Rouge were conducted on old Olivier silt loam, Mississippi River terrace soil that was naturally poor, being especially low in nitrogen and phosphorus. It had a pH of about 5.4. Soil of this type runs together and compacts badly during hard rains. The soil at Calhoun was a deep sandy loam, characteristic of the hill section of North Louisiana. The soil at St. Joseph was Sarpy, very fine sandy loam high in fertility and organic matter.

In the experiments from which the above data were taken, legumes other than Common vetch were used. The germination, or final emergence, of Austrian Winter peas and Hairy vetch was not significantly different from that of the Common vetch. The germination of Bur clover and *Melilotus indica*, used in the experiments at Baton Rouge and Calhoun, was practically nil from a depth of four inches or greater.

Based on the results of these tests it may be concluded that the vetches and Winter peas may be safely planted at depths ranging from one to six inches.

Methods of Planting Vetch or Winter Peas

There are many methods of planting vetch or Winter peas, and like all other farm operations some are successful, some are not. The two main factors on which success depends are drainage and seed coverage. Five methods of planting are:

TABLE 11. Depth of Planting Common Vetch

Location	Depth of planting, inches	Per cent germination		
		1940	1941	1942
Baton Rouge	0	47.4	23.0	53.0
	2	81.5	87.0	88.0
	4	61.5	80.0	83.0
	6	48.3	67.0	77.0
	8	42.2	32.0	65.0
Calhoun	0	33.1	19.8	4.0
	2	89.4	86.2	89.0
	4	62.5	83.8	86.0
	6	49.1	58.0	59.0
	8	26.3	28.2	56.0
St. Joseph*	0	77.3		
	2	86.3		
	4	83.0		
	6	59.3		
	8	45.7		

*Only one year

(1) *Broadcast the seed and break out the middles.* This is probably one of the best methods of planting since the seed are all thrown up out of the middle onto the sides and top of the row and are well covered and the old cotton stalks are left to protect the plants in seedling stage and act as support when vetch begins to make good growth. This protection given the seedling plants by the old cotton stalks is very important. Often during heavy rain the young seedlings are washed up or their roots become exposed, increasing the danger of winter kill unless protected by the old cotton stalks. A modification of this plan is to broadcast the seed and break out old cotton rows lightly with a middle buster. This method, while not giving protection like that of the old cotton stalks, covers the seed to sufficient depth so that very little damage is done in case of heavy rain.

(2) *Break out old cotton rows and seed with a planter on top of the newly-formed row.* Seeding may be done with an ordinary planter with runner wing dirt shields or with a grain drill following disk. This method has proved very successful as it insures placement of seed where drainage will be good, though it provides no protection to the seedlings in the event of heavy rain.

(3) *Disk down old rows almost flat and seed with grain drill.* This method has proved very successful, but the spouts over the middles should be plugged to prevent any planting where lack of drainage would prevent growth.

(4) *Seed at the time of last cultivation of cotton.* This method has not proved entirely satisfactory, as indicated, and for the reasons given in Table 10.

(5) *Airplane seeding.* This method has not proved entirely successful and if it is used, seeding should be done just prior to defoliation of the cotton. In this case the falling cotton leaves give some cover to the

seed. This method's principal disadvantage in addition to failure to cover the seed is that most of the seed roll into the middles and lack of drainage prevents their successful growth. Seeding by airplane, followed by Method No. 1 described above, is recommended.

SUMMER LEGUMES

Work has been conducted at this Station with various summer legumes, such as soybeans, cowpeas, and *Crotalaria* but, as soybeans proved to be better adapted than others, only the work with this legume is considered in his report. Another reason the soybean was used more than other legumes is that the crop is widely grown commercially and the practice of interplanting it with corn is in rather general use. Because of the fact that the roots of the soybean penetrate the subsoil, a physical benefit is obtained in addition to the fixation of nitrogen.

A test was conducted for 11 years in which corn and soybeans interplanted were followed by cotton, the corn and soybeans being handled in various ways. Treatment 1 was planted to corn alone and used as a check. Four other treatments were used as follows: (1) Immediately after the corn was harvested the cornstalks and beans were cut close to the ground with a mowing machine, the residue raked off, and the stubble turned under immediately; (2) Same as No. 1, except that the stubble was not turned under until spring; (3) Immediately after the corn was harvested, the cornstalks and beans were disked and turned under; (4) Same as No. 3, except the stalks were not turned under until spring. Cotton was planted the following year and no fertilizer was used. Results of this test are given in Table 12.

TABLE 12. Cotton Following Corn and Soybeans Handled Various Ways

Item	Yield cotton, 11-year av. lbs. per acre	Increase over corn alone, lbs. per acre
Corn alone	956	-----
Corn and beans cut, raked off, and stubble turned under in fall	1697	741
Corn and beans cut, raked off, and stubble turned under in spring	1650	694
Corn and beans, all turned under in fall	2049	1093
Corn and beans, all turned under in spring	1899	943

As may be seen from the table, very profitable increases in yield of cotton were obtained from all treatments. In cases where the corn and beans were cut and removed there was very little difference due to time of turning under. Where the corn and beans were all turned under the increase from fall turning was considerably greater than that from spring turning, probably because of the more complete decomposition of the material turned under, especially the cornstalks. Where the corn and

beans were turned under in spring there was considerable difficulty in planting and early cultivation. It may also be seen from the table that there was a very profitable increase in yield of cotton from turning under the whole plants rather than the stubble only.

After cotton had been grown on the plots, corn and beans were again planted the following year. No fertilizer was applied to the corn as it was desirable that the residual effect, if any, from the beans grown two years previously be observable. The results are given in Table 13.

TABLE 13. Corn Yields

Item	Five-year average, bu. per acre
Corn alone	30.9
Corn and beans cut, raked off, and stubble turned under in fall	31.3
Corn and beans cut, raked off, and stubble turned under in spring	32.9
Corn and beans, all turned under in fall	39.2
Corn and beans, all turned under in spring	39.2

Table 13 shows that there was very little carry-over value to the corn crop where the corn and bean stalks had been removed. Where the entire plants had been turned under, however, there was significant increase in corn yield.

Another test was conducted for two years to determine the value of soybeans when planted various ways, eight-row plots being used. Treatment 1 was corn alone and used as check, as in the preceding experiment. In Treatment 2, corn and beans were interplanted. In Treatment 3, two rows of corn and two rows of beans were alternated to make up the eight rows. The corn was fertilized with 60 pounds of available nitrogen applied before planting. In Treatment 3 the rows planted to corn received the same rate of nitrogen per acre as the other treatments, but no fertilizer was applied to rows in which beans were grown. The yields of cotton which resulted are given in Table 14.

TABLE 14. Cotton Following Various Methods of Planting Corn and Beans

Item	Yield cotton, two-year. av., lbs. per acre
Corn alone	1366
Corn and beans interplanted	1904
Corn and beans, double rows	1903

As may be seen from Table 14, there was a very profitable increase obtained from the treatments with beans over the corn alone. There was no difference between the yield of cotton from the interplanted method and the yield from the double-row method. No fertilizer was applied to the cotton.

Yields of corn were taken from the various treatments and are given in Table 15.

TABLE 15. Corn Yields

Item	Two-year average, bu. per acre
Corn alone	66.5
Corn and beans interplanted	48.1
Corn and beans, double rows	55.6

The best yield of corn, as shown in Table 15, was obtained where corn was grown alone. There was some decrease in yield of corn from the double-row method but not as much as where corn and beans were interplanted. In Treatment 3, the double-row method, the beans were harvested with a combine following harvesting of corn. The two-year average yield of beans was 16.3 bushels per acre, which more than offset the loss in yield of corn.

SUMMARY

1. Growing and turning under winter legumes increased the yield of cotton from one bale to one and one-half bales per acre and maintained the high yield over a period of 23 years. The application of 24 pounds of available nitrogen barely maintained the original production.
2. Hairy vetch, Smooth vetch, Woolypod vetch, Southern Winter peas (*Lathyrus hirsutus*), and Southern Bur and Manganese clovers gave the best results. Crimson clover showed considerable promise, especially on well-drained land, but was not in test long enough to allow conclusions to be drawn about it.
3. The best date for turning under winter legumes is about April 1.
4. The best rate of seeding Common vetch was found to be 25 to 35 pounds per acre.
5. After turning under good growths of winter legumes for three years it was found that the beneficial effect extended to the second and third cotton crop following.
6. The application of 30 pounds of nitrogen per acre at the time the winter legume was turned under proved to be profitable. Turning under a good growth of winter legumes every other year alternated with the application of 45 pounds of nitrogen maintained relatively high yields of cotton.
7. The best time for planting vetch was found to be during October.
8. The best depth for planting vetch and Winter peas was found to be two-four inches.
9. Various methods of planting vetch or Winter peas may be used successfully if seed are well covered and good drainage is provided.
10. The growing of soybeans interplanted with corn increased the yield of cotton the next year more than one-half bale per acre. The greatest increase was obtained where the corn and bean stalks were turned under in the fall, after harvesting of corn. The beneficial

effect of the beans carried into the second year, increasing corn yields 26.8 per cent over corn alone. Corn and soybeans grown in alternate double rows gave the same increase in yield of the cotton following as did corn and soybeans interplanted. A yield of 16.3 bushels of beans per acre was recovered from the alternate double-row planting method.

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.....their number, characteristics,
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OLDER RURAL YOUTH IN LOUISIANA

Their Number, Characteristics, and Needs¹

A. L. BERTRAND

INTRODUCTION

It has been said that the future of the nation rests on the shoulders of its youth. In view of this statement, one would expect those interested in rural life to have amassed a wealth of information on persons in the rural population ranging from 15 to 30 years of age.² Yet, inspection of the pertinent literature reveals, with the exception of the specialized studies made during the depression years, a dearth of material of this nature. This apparent oversight on the part of researchers assumes significant proportions when one contemplates the momentous decisions—in connection with leaving the family group, preparing for an occupation or vocation, getting married, establishing a home, buying a farm, rearing a family, leaving the rural environment, and so forth—which rural people of this age must face and concerning which they would welcome reliable information and counsel.

Extension and other agricultural workers have not been unaware of the need in terms of programs designed for older rural youths. In fact, the Agricultural Extension Service in several states has made highly commendable efforts to help them solve their problems. More extensive efforts have not been made, primarily because of the lack of verified and consequently reliable information on the characteristics, interests, and needs of these youths, however. It is thus that the rural sociologists and other rural social scientists have an opportunity as well as a challenge to make worthwhile contributions.³ The present study purports to

¹This study was made after consultation with Director H. C. Sanders of the L.S.U. Agricultural Extension Service to determine research of a rural sociological nature most needed by Extension people. Many persons helped in one way or another in bringing this work to a successful conclusion. Among these, Mr. Joe G. Richard, assistant director and state agent, and Mr. Julius M. O'Quin, state 4-H Club and older youth agent, of the L.S.U. Agricultural Extension Service were extremely active in the preliminary planning necessary for the survey part of the study. Mr. Richard, Mr. O'Quin, Mr. G. L. Burseson, Miss Ellen LeNoir, and Mr. Morris M. LaCroix of the state Extension staff participated directly in the preparation of the schedule. Other Extension people, especially the district agents, were also consulted in this connection. The field work could not have been done without the cooperation and assistance of the county Extension personnel in the six parishes visited.

²See E. W. Aiton, *Extension Work With Young Men and Women*, (Washington: U.S. Department of Agriculture, October 1949).

³The New England Pilot Project for work with young men and women, under the direction of Edna Sommerfeld and William R. Miller, regional Extension agents, represents an outstanding effort in this direction.

be an effort in this direction insofar as the state of Louisiana is concerned. Its specific objectives and methods of procedure are outlined below.

Objectives

The major objectives of this study were three in number. The first concerned itself with the determination of the number and distribution of persons 15 to 30 years of age living in rural areas of Louisiana. The value of such information to persons in charge of action programs is self-evident. It answers the many preliminary planning questions having to do with "how many" and "where" that are vital. Knowledge of this sort also indicates the importance of particular segments of the rural youth population, such as the breakdowns by race and sex. In addition it is of significance to know what proportion of the total rural population is included in the "older youth" group. All in all, it may well be said that information of the above nature is basic in the study of any specific population entity.

The second aim of the present study was to acquire information relative to selected socio-economic characteristics of "older youth" in rural areas. In this regard, data on the sex, age, race, social participation, aspirations, and allied attributes of these persons were collected. Knowledge of this kind obviously is fundamental to an intelligent approach to work with young people. For example, the answer to questions as "Are young people on the farm inclined to steer away from agriculture as a life's work?" can mean a great deal to the program planner for older rural youth work. In addition, there is much value in such information as the types of activities which appeal to this particular group as well as in the knowledge of what part of their environment they are dissatisfied with. These and like questions were studied under the second objective.

The final purpose in mind was to obtain information about the interests of older youths themselves with respect to topics, places, and time for educational and recreational programs. There has been much speculation on these particular points and it seemed a place where a valuable contribution might be made. Thus, if information on marriage and the family, vocational guidance, etc., is desired on week ends in a neighborhood setting, the work of Extension and other specialists is made easier by aforehand knowledge.

Methodology

The importance of any scientific study hinges directly on the validity of its methodological procedures. The refinement of the latter, of course, depends to a great extent on the objectives and purposes of the particular study. As the title implies, the present study is concerned with rural youth only. This means that only persons falling in the rural-nonfarm and rural-farm residence categories as defined by the Seventeenth Decennial Census were included in the analysis.

Since the first part of the study was concerned primarily with data from the 1950 Census for the state as a whole, no sampling problem was

involved. In this connection the tardiness of the Census Bureau in publishing detailed state data by age groups prevented the making of a more elaborate analysis of these characteristics.

Several factors contributed to the final decisions with respect to the techniques and procedures followed in the second and third parts of the present effort. The following factors were carefully considered in making the selection of sample survey areas. First, the limitation of financial resources, which set the maximum number of sample areas at six, was a determining factor. Second, the wish of the state Agricultural Extension Service to check on and evaluate the results of past efforts in terms of older youth work was considered.

To satisfy these requirements, the survey parishes were chosen so as to include two parishes in which an intensive program of older youth work had been or was being carried on, two parishes in which moderately active programs of this type had been or were in existence, and two parishes in which no work of this nature had ever been done. (See Figure 1.) In this regard, the comparative data has not been analyzed in this report because of the small number of cases involved. Third, it

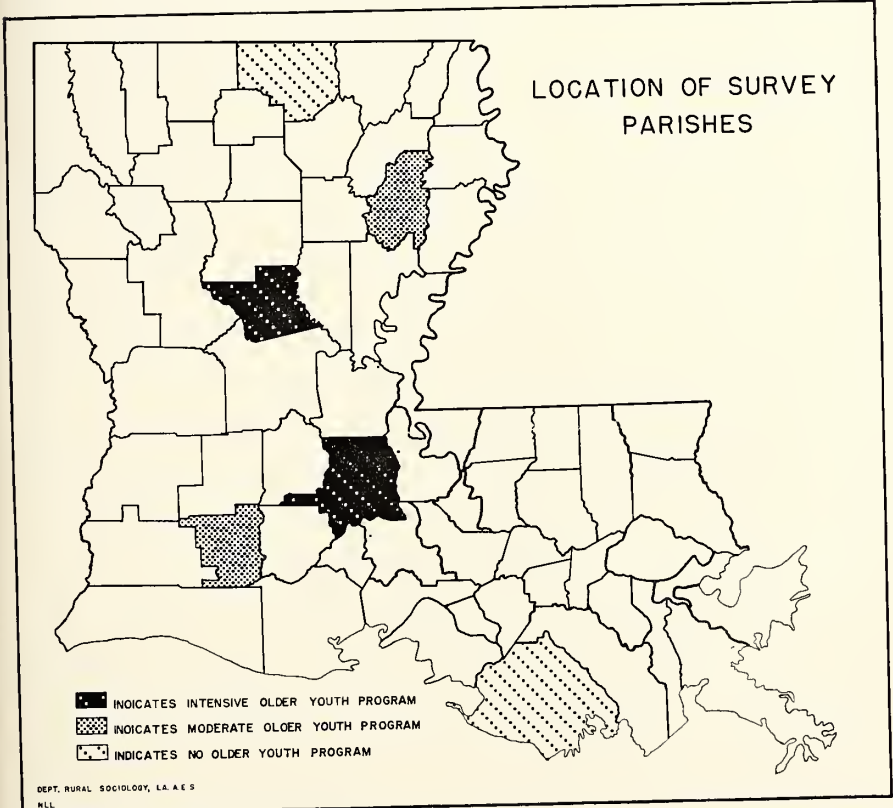


FIGURE 1. Map of Louisiana showing the location of the six survey parishes, 1952.

was deemed of importance to sample, insofar as possible, the major cultural and type-of-farming areas in the state. The selection of the particular parishes shown in Figure 1 was done with this in mind.

A second set of sampling problems concerned the location and selection of interviewees falling within the required age limits in the sample parishes. The complete and wholehearted cooperation of the Extension people at all levels provided a way out of the dilemma of "working blindly" in the effort to discover where the older youth lived in each parish. On highway maps procured by the administrative personnel in the state office, the county agents of the various parishes and their staffs located by name a representative group of older youths in rural areas known to them. With this information, and in many instances with Extension personnel as guides, interviewers lost little time in searching out interviewees. It may be noted that it was not possible to get anything like a complete coverage of older youths in each parish. Thus, in allotting the available time for interviews, careful attention was given the matter of geographic location. In other words, interviewers were dispatched to take a proportionate sample in every populated area of the survey parishes.

With relation to a representative sample, one important segment in the older youth population, the non-whites, was not interviewed. The decision to interview only white youths was prompted by the scope of a comparative study which was beyond the time and resources available. The sentiments of the Extension staff concerned and of the writer, in this respect, were that a second study of the needs and problems of the older Negro youths should follow and supplement the present study.

Interviews were conducted by carefully trained enumerators using a survey schedule designed to obtain a maximum amount of information in a minimum amount of time. Ample space was provided for recording chance remarks of interviewees which might have significance in the study. Altogether, 562 persons were interviewed. Of this number, 310 were females and 252 were males.

The information obtained from the Census and the survey was sorted and tabulated in the conventional manner with reliance placed on a simple and straightforward analysis. In order to make comparisons possible, the data for the most part is recorded by sex groups.⁴

THE NUMBER, DISTRIBUTION, AND COMPOSITION OF THE OLDER RURAL YOUTH POPULATION

The starting point for any state-wide program directed toward older youth is the number and characteristics of the people to be served. Accordingly the information which follows is concerned with these aspects of the older rural youth population in Louisiana.

⁴In this connection a second report is to be concerned with the interrelationship of sex, age, residence, marital status, and occupation to the stated interests and needs of the survey population.

Fortunately, the Seventeenth Decennial Census of the United States is of such recent date that the information appearing in it is up to date. All of the data which follow are taken from this publication.

The Number of Older Rural Youth

Louisiana, although it now has more people classified as urban residents (54.8 per cent) than it has as rural residents, is still one of the most rural states of the nation. This means that, relatively speaking, there should be a large number of older rural youth in the state. To be exact there were, in 1950, 271,461 persons aged from 15 through 29 years in the rural-farm and rural-nonfarm population of the state. It may be surprising to some to learn that this number makes up one-tenth of the total population and 22.4 per cent of the rural population of the state. One significant fact is made clear by the above statistics. There are enough older rural youth in the state to make their guidance a matter of serious public concern.

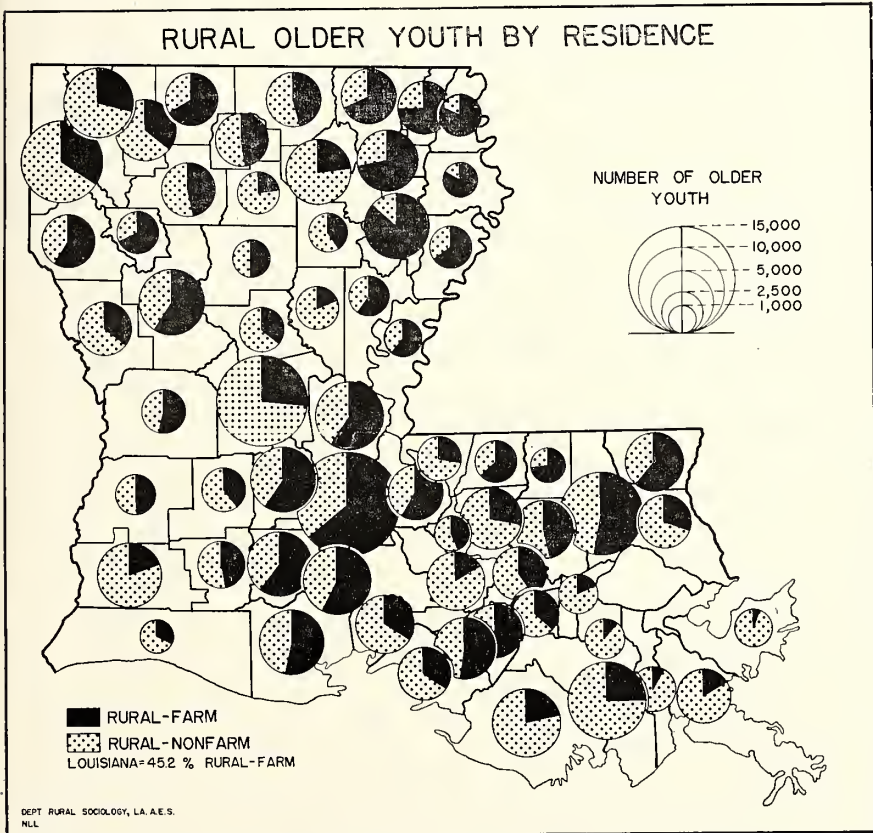


FIGURE 2. Older youth population of the parishes of Louisiana, by residence, 1950. (Source of data: Seventeenth Census of the United States.)

Distribution of Older Rural Youth

Table 1 and Figure 2 were prepared to show the distribution of older rural youth, geographically, over the state. It is immediately obvious that persons in these age groups are concentrated in certain areas. The greater number of older rural youth are to be found in the south central parishes of the state. St. Landry Parish has the largest number of persons within this age group (14,326) and is followed by Rapides Parish (10,454). The south Louisiana parishes with the exception of Cameron, St. James, St. Charles, St. John the Baptist, Jefferson, and St. Bernard rank second as an area of older rural youth population concentration. Interestingly, the north Louisiana upland cotton parishes rank third in this respect. Standing out as having a dearth of persons in the ages from 15 through 29 years are the southwest and central Louisiana parishes falling into what is known as the cutover areas. The upper Mississippi Delta parishes and aforementioned south Louisiana parishes centering around New Orleans also have relatively few youths of these ages. It is interesting to note in Figure 2 that, although the distribution of older rural youth generally follows the distribution of the total population of the state, there are inconsistencies between the two in the peak population concentrations.

Residential Composition of the Older Rural Youth Population

When rural youth are divided according to residence the following numerical distribution prevails.⁵ The rural-farm group in 1950 included 122,836 individuals as compared with 148,625 persons listed as in the rural-nonfarm group. Put another way, 45.2 per cent of the rural youth aged 15 through 29 years live on bona fide farms, whereas 54.8 per cent live in rural areas but not on farms.

Residence differentials in distribution of the older rural youth population are quite pronounced. Although there are generally fewer rural-farm youth than rural-nonfarm youth their areas of highest and lowest concentration do not coincide. For example, the extreme southeastern parishes stand out as having the highest number of youth in the rural-nonfarm residence classification and the least number in the rural-farm classification. The whole group of Mississippi Delta cotton parishes have a dearth of rural-nonfarm young people but a relatively high number of rural-farm youth. The south central Louisiana parishes stand out as the home of rural-farm older youth but show only an average concentra-

⁵The definitions of "rural-farm" and "rural-nonfarm" used are the same as those of the Seventeenth Decennial Census of the United States. The major distinction in the two residential classifications is that the rural-farm group includes all persons living on farms exclusive of those paying cash rent for house and yard only, or living in institutions, summer camps, or tourist courts. The rural-nonfarm group includes all other persons living in rural areas, including those in population centers of less than 2,500 people. In the above connection a change in definition from the 1940 to the 1950 Census affected the count of rural youth in 11 parishes. This discrepancy is not of sufficient import to affect the conclusions presented, however.

tion of rural-nonfarm persons classifiable under this heading. Persons interested in the figures for individual parishes may consult Table I.

Sex Composition of the Older Rural Youth Population

Rural populations traditionally have been known for their high sex ratios. In other words one expects to find more males than females in any given farm population. As may be seen in Table II, this is the case for the total rural youth population of the state, but just barely so. The sex ratio for this group is 100.7, indicating there are less than 101 young men for every 100 young women. This narrow gap in the balance between males and females is highly significant. It implies that there may be a redistribution of the sexes in the years to come. Such trends, of course, have been noticed in the United States population as a whole for some time.

The imbalance between the sexes in the older rural youth population makes itself known in the two residence groupings. For example, the sex ratio for the rural-farm population is 105.7 in contrast to 96.7 for the rural-nonfarm population. The above ratios mean that there are considerably more males among the older rural youth on farms, while there are considerably more females among the older rural youth residing in nonfarm areas. These findings should have many implications for the social planner or Extension worker.

There is no consistent areal pattern in sex composition of the older rural youth population as a whole. However, the Florida and sugar parishes seem to have slightly higher sex ratios than the parishes located in the more northern parts of the state. It may be noted that only 26 of the 64 parishes have sex ratios which are over 100. As might be expected, the rural-farm older youth population of the various parishes generally have high sex ratios. Nevertheless at least 12 parishes (see Table II) have sex ratios of less than 100. In this connection there is some tendency for the south Louisiana parishes to have higher sex ratios. The rural-nonfarm older youth population varies so much in sex composition that it is impossible to detect regional differences sufficiently pronounced to determine positive statements on sex ratios.

Age Composition of the Older Rural Youth Population

Since the term "older youth" has been used to include all ages from 15 through 29 years, it is pertinent to include a more detailed analysis of ages at this time. Table III was prepared to show the age composition of the older rural youth population by residence and parish. In this connection the Census categories determined the breakdowns which are used. In studying the data collected, several interesting discoveries can be made. The first striking observation is that there is a considerably larger number of youth in the younger age groups than in the older ones. As many as two-fifths (40.4 per cent) of the total rural youth population is from 15 through 19 years of age. Three-tenths (30.9 per cent) of the rural youth of the state are from 20 through 24 years old. It may be noted

TABLE I
OLDER RURAL YOUTH POPULATION CHANGE BY
RESIDENCE, LOUISIANA, 1940-1950

Parish	Rural-Farm			Rural-Nonfarm			Total		
	1940	1950	Per Cent Change	1940	1950	Per Cent Change	1940	1950	Per Cent Change
Acadia	6471	3553	-45.1	2422	2343	-3.3	8893	5896	-33.7
Allen	1725	1143	-33.7	1999	1756	-12.2	3724	2899	-22.1
Ascension	2801	1624	-42.0	1967	2346	19.3	4768	3970	-16.7
Assumption	2815	1647	-41.5	2421	2078	-14.2	5236	3720	-29.0
Avoyelles	6992	3828	-45.3	2935	2637	-10.2	9927	6465	-34.9
Beauregard	2012	1187	-41.0	881	1222	38.7	2902	2409	-17.0
Bienville	4730	1803	-61.9	1840	2070	12.5	6570	3873	-41.1
Bossier	4595	1874	-59.2	4276	4837	13.1	6252	6711	7.4
Caddo	2961	2961	-61.6	6548	5911	-9.7	14264	8871	-37.8
Calcasieu	2461	1151	-53.2	5284	4701	-11.0	7745	5852	-24.4
Caldwell	1898	855	-55.0	1440	1279	-11.2	3338	2134	-36.1
Cameron	1165	479	-58.9	879	997	13.4	2044	1476	-27.8
Catahoula	2791	1498	-46.3	997	1003	0.6	3788	2501	-34.0
Claiborne	5853	2523	-56.9	1534	1271	-17.1	7387	3794	-49.1
Concordia	2284	1368	-40.1	757	890	17.6	3041	2258	-25.7
DeSoto	6064	2343	-61.4	1443	1591	10.3	7507	3934	-47.6
E. Baton Rouge	2703	1407	-47.9	13030	3632	-72.1	15733	5039	-68.0
E. Carroll	3887	2110	-45.7	284	468	64.8	4171	2578	-38.2
E. Feliciana	2672	1745	-34.7	589	995	68.9	3261	2740	-16.0
Evangeline	5812	3371	-41.9	1740	2300	32.2	7552	5671	-24.9
Franklin	7583	4915	-35.2	578	789	36.5	8161	5704	-30.1
Grant	1940	1014	-47.7	2367	1823	-23.0	4307	2837	-34.1
Iberia	3653	1497	-59.0	2160	2881	33.4	5813	4378	-24.7
Iberville	3041	741	-75.6	3248	3694	13.7	6289	4435	-29.5
Jackson	2207	712	-72.3	2160	712	-7.7	4367	2606	-40.3
Jefferson	512	236	-53.9	9091	2704	-70.3	9603	2940	-69.4
Jeff.-Davis	2616	1490	-43.0	1898	1652	-13.0	4514	3142	-30.4
Lafayette	5476	3478	-36.5	1562	2579	65.1	7038	6057	-13.9
Lafourche	4312	1946	-54.9	5460	5894	7.9	9772	7840	-19.8
LaSalle	1064	516	-51.5	1943	2172	11.8	3007	2688	-10.6
Lincoln	4313	1886	-56.3	749	2094	179.6	5062	3980	-21.4
Livingston	3124	2186	-30.0	1795	2502	39.4	4919	4688	-4.7
Madison	3040	1620	-46.7	294	326	10.9	3334	1946	-41.6

TABLE 1 (CONT'D.)
OLDER RURAL YOUTH POPULATION CHANGE BY
RESIDENCE, LOUISIANA, 1940-1950

Parish	Rural-Farm			Rural-Nonfarm			Total	
	1940	1950	Per Cent Change	1940	1950	Per Cent Change	1940	1950
Morchouse	4708	2894	-38.5	979	1345	37.4	5687	4239
Natchitoches	7184	3404	-52.6	2006	2451	22.2	9190	5835
Orleans	*	*	*	*	*	*	*	*
Ouachita	3441	1329	-61.4	2029	4481	70.4	6070	5810
Plaquemines	1195	578	-51.6	2254	2965	31.5	3449	3543
Point Coupee	5204	2371	-54.4	1602	1687	5.3	6806	4058
Rapides	5748	2781	-51.6	5027	7673	36.4	11375	10454
Red River	3553	1649	-53.6	911	791	-13.2	4464	2440
Richland	6382	3815	-40.2	1570	1446	7.9	7952	5261
Sabine	3602	1522	-57.7	2993	2763	7.7	6395	4285
St. Bernard	222	127	-42.8	1763	1990	12.9	1985	2117
St. Charles	640	286	-55.3	2675	2144	-19.9	3315	2430
St. Helena	2211	1447	-34.6	301	535	77.7	2512	1982
St. James	1840	1173	-36.3	2866	2009	-29.9	4706	3182
St. John	930	426	-54.2	3230	1906	-41.0	4160	2332
St. Landry	12525	9201	-26.5	3438	5125	49.1	15963	14326
St. Martin	4592	2759	-39.9	1824	2534	38.9	5742	5293
St. Mary	2734	1255	-54.1	3008	2408	-19.9	3663	362
St. Tammany	1440	1136	-21.1	2882	2590	-10.1	4322	3726
Tangipahoa	7319	4380	-37.4	2762	4085	47.9	10081	8665
Tensas	3359	1675	-50.1	940	907	-3.5	4299	2582
Terrebonne	3456	1391	-59.8	4146	5039	21.5	7602	6430
Union	4059	1939	-58.4	1411	2261	60.2	6070	4200
Vermilion	5240	2887	-44.9	2787	2322	-9.5	8027	5409
Vernon	2613	1516	-42.0	1707	1302	-23.7	4320	2818
Washington	4510	2809	-37.7	1127	1769	57.0	5627	4578
Webster	4622	1786	-61.4	3270	3270	30.7	7123	5056
W. Baton Rouge	1866	816	-56.3	1262	1020	-19.2	3128	1836
W. Carroll	4468	2798	-37.4	980	959	-2.1	5448	3757
W. Feliciana	2865	824	-71.2	566	2161	281.8	3431	2985
Winn	2278	1055	-53.7	1189	1056	-11.2	3467	2111
Total	235734	122836	-47.9	150507	148625	-1.3	386241	271461

TABLE II
SEX COMPOSITION OF THE OLDER RURAL YOUTH
POPULATION BY RESIDENCE, LOUISIANA, 1950

Parish	Rural-Farm			Rural-Nonfarm			Total		
	Male	Female	Sex Ratio	Male	Female	Sex Ratio	Male	Female	Sex Ratio
Acadia	1832	1721	106.4	1151	1192	96.6	2983	2913	102.4
Allen	584	559	104.5	839	917	91.5	1423	1516	93.9
Ascension	856	768	111.5	1131	1215	93.1	1987	1983	100.2
Assumption	818	829	98.7	1024	1054	97.2	1842	1883	97.8
Avoynes	2025	1803	112.3	1278	1359	94.0	3303	3162	104.5
Beauregard	638	549	116.2	555	667	83.2	1193	1216	98.1
Bienville	964	839	114.9	975	1095	89.0	1939	1934	100.3
Bossier	940	934	100.6	3513	1294	273.8	4483	2228	201.2
Caddo	1455	1506	96.6	2808	3103	90.5	4263	4609	92.5
Calcasieu	619	532	116.4	2262	2439	92.7	2881	2971	97.0
Caldwell	434	421	103.1	631	648	97.4	1065	1069	99.6
Cameron	287	192	149.5	487	510	95.5	774	702	110.3
Catahoula	770	728	105.8	471	532	88.5	1241	1260	98.5
Clairborne	1322	1201	110.1	594	677	87.7	1916	1878	102.0
Concordia	664	704	94.3	404	486	83.1	1068	1190	89.7
DeSoto	1175	1168	100.6	711	880	80.8	1886	2018	93.5
E. Baton Rouge	733	674	108.8	1721	1911	90.1	2454	2585	94.9
E. Carroll	1033	1077	95.9	238	230	103.5	1271	1307	97.2
E. Feliciana	919	826	111.3	478	517	92.5	1397	1343	104.0
Evangeline	1764	1607	109.8	1111	1189	93.4	2875	2796	102.8
Franklin	2451	2464	99.5	347	442	78.5	2798	2906	96.3
Grant	528	486	108.6	864	959	90.1	1392	1445	96.3
Iberia	806	691	116.6	1385	1496	92.6	2191	2187	100.2
Iberville	391	350	111.7	1870	1824	102.5	2261	2174	104.0
Jackson	310	302	102.6	923	1071	86.2	1233	1373	89.8
Jefferson	113	123	91.9	1312	1392	94.3	1425	1515	94.1
Jeff. Davis	777	713	109.0	782	870	89.9	1559	1583	98.5
Lafayette	1807	1671	108.1	1244	1335	93.2	3051	3006	101.5
LaFourche	1055	891	118.4	2911	2983	97.6	3866	3874	99.8
LaSalle	270	246	109.8	1037	1135	91.4	1307	1381	94.6
Lincoln	940	946	99.4	980	1114	88.0	1920	2060	93.2
Livingston	1130	1056	107.0	1205	1297	92.9	2415	2353	102.6
Madison	834	786	106.1	152	174	87.4	986	960	102.7

TABLE II (CONTD.)
SEX COMPOSITION OF THE OLDER RURAL YOUTH
POPULATION BY RESIDENCE, LOUISIANA, 1950

Parish	Rural-Farm				Rural-Nonfarm				Total	
	Male	Female	Sex Ratio		Male	Female	Sex Ratio		Male	Female
Morehouse	1406	1488	94.5		641	704	91.1		2047	2192
Natchitoches	1704	1700	100.2		1139	1312	86.8		2843	3012
Orleans	*	*	*		*	*	*		*	*
Ouachita	699	630	111.0		2123	2358	90.0		2822	2988
Plaquemines	297	281	105.7		1514	1451	104.3		1811	1732
Pointe Coupee	1229	1142	107.6		779	908	85.8		2008	2050
Rapides	1441	1340	107.5		3534	4159	85.4		4975	5479
Red River	800	849	94.2		359	432	83.1		1159	1281
Richland	1926	1889	102.0		639	807	79.2		2565	2696
Sabine	769	753	102.1		1289	1474	87.4		2058	2227
St. Bernard	71	56	126.8		965	1025	94.2		1036	1081
St. Charles	156	130	120.0		1068	1076	99.3		1224	1206
St. Helena	746	701	106.4		249	286	87.1		995	987
St. James	611	562	108.7		1017	992	102.5		1628	1554
St. John	223	203	109.9		976	930	104.9		1199	1133
St. Landry	4741	4460	106.3		2351	2774	84.8		7092	7234
St. Martin	1475	1284	114.9		1200	1334	90.0		2675	2618
St. Mary	612	643	95.2		1176	1232	95.5		1788	1875
St. Tammany	606	530	114.2		1290	1309	99.2		1896	1830
Tangipahoa	2341	2239	104.6		1898	2187	86.8		4239	4426
Tensas	791	884	89.5		402	505	79.6		1191	1389
Terrebonne	732	659	111.1		2537	2502	101.4		3269	3161
Union	1031	908	113.5		1074	1187	90.5		2105	2095
Vermilion	1519	1368	111.0		1214	1308	92.8		2676	102.1
Vernon	785	731	107.4		609	693	87.9		1394	1424
Washington	1451	1358	106.8		843	926	91.0		2284	100.4
Webster	929	857	108.4		1531	1736	88.4		2463	2593
W. Baton Rouge	396	420	94.3		507	513	98.8		903	933
W. Carroll	1399	1399	100.0		455	504	90.3		1854	1903
W. Feliciana	446	378	118.0		1727	434	397.9		2173	812
Winn	546	509	107.3		531	525	101.1		1077	1034
Total	63122	59714	105.7		73064	75561	96.7		136186	135275

that these differentials could be expected in terms of what is known of rural birth rates and migration patterns.

The differential between the ages of the rural-farm and rural-nonfarm youth are extremely significant. Among the former, almost half (47.0 per cent) of the persons included are from 15 through 19 years of age. In contrast just over one-third (35.0 per cent) of the rural-nonfarm youth are in this age category. Only 28.4 per cent of the rural-farm youth are from 20 through 24 years' old, while one-third (33.0 per cent) of the rural-nonfarm youth are within the limits of these ages. Less than one-fourth of the rural-farm youth are from 25 through 29 years of age but almost one-third (32.0 per cent) of the rural-nonfarm youth are within these age brackets. The general conclusion is that the rural-farm older youth are relatively younger than the rural-nonfarm older youth.

Areal differences in age distribution follow the residence composition of the various parishes very closely. Thus the rural-farm older youth population of each parish generally has a larger proportion of older youth in the younger age groups. Proximity to large urban centers seems to influence the distribution of the ages in the various age categories to some extent, however. Interested persons may find the exact composition of each parish's population in Table III.

Race Composition of the Older Rural Youth Population

Despite the fact that the survey part of this study is limited to white youth, in a state such as Louisiana it is extremely important to take into consideration the non-white population. This is manifested in the fact that 36.3 per cent (98,621) of the total older youth population is non-white. Residence breakdowns of the racial composition of the older youth population are even more enlightening. Of all the older youth living in rural-farm areas, as many as 42.7 per cent are non-white. In contrast only 31.1 per cent of the rural-nonfarm older youth population is non-white.

The proportion of the older rural youth population that is non-white varies from one part of the state to the other, as can be seen in Figure 3 and Table IV. Keeping the residence differentials in mind, the highest proportions of non-whites in the rural-farm older youth population are found in the upper Red River Delta section and the north Louisiana upland cotton section of the state. The south central Louisiana mixed farming parishes and the Mississippi Delta cotton parishes also have relatively high proportions of non-white youth in their rural-farm population. The southwest Louisiana parishes and the west central cutover parishes have the least number of non-whites among their older rural youth population, relatively speaking.

Three fairly well defined areas stand out as having relatively high proportions of non-white persons among their rural-nonfarm older youth population. The first includes a cluster of north central Louisiana parishes in the upland cotton area. The second includes the upper tier

RURAL-FARM OLDER YOUTH BY RACE

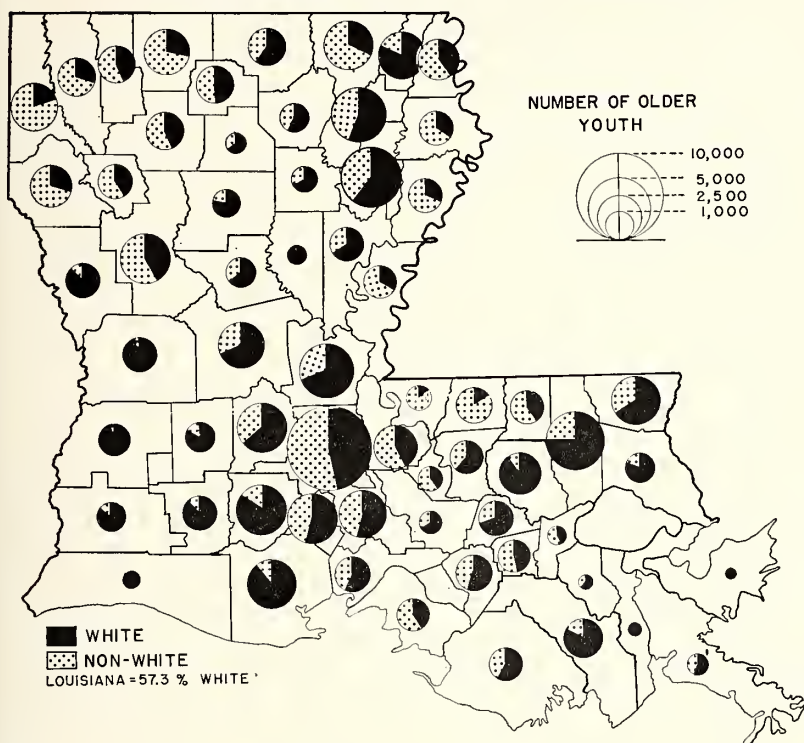


FIGURE 3. Rural-farm older youth population of the parishes of Louisiana, by race, 1950 (Source of data: Seventeenth Census of the United States)

of parishes bordering the Mississippi River and extending from East Carroll Parish to Concordia Parish. The third area includes East and West Feliciana, Pointe Coupee, East and West Baton Rouge, Iberville, and St. Mary Parishes. The south and central Louisiana parishes, in general, have the lowest proportion of non-whites in their older rural-nonfarm youth population.

Trends in the Older Rural Youth Population

For many years the rural population of the United States has been decreasing relative to the urban population. In Louisiana the urban population exceeded the rural population for the first time in 1950. Social scientists observing these trends have speculated on the final outcome of this long-time shift in residence of the population. In this connection some persons working with rural people have viewed the exodus of youth from the farms with great concern. In fact, the stimulus for the present study resulted in great part because of this phenomenon.

TABLE III
AGE COMPOSITION OF OLDER RURAL YOUTH POPULATION
BY RESIDENCE, LOUISIANA, 1952

Parish	Rural-Farm						Rural-Nonfarm						Total													
	15-19 Yrs.			25-29 Yrs.			15-19 Yrs.			20-24 Yrs.			25-29 Yrs.			15-19 Yrs.			20-24 Yrs.			25-29 Yrs.				
	No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent			
Acadia	1623	45.7		1046	29.4		884		24.9	916	39.1		737	31.5		690	29.4		2539	43.1		1783	30.2		1574	26.7
Allen	531	46.5		319	27.9		293		25.6	618	35.2		585	33.3		553	31.5		1149	39.6		904	31.2		846	29.2
Assumption	755	46.5		442	27.2		427		26.3	780	33.2		779	33.2		787	33.6		1535	38.7		1221	30.7		1214	30.6
Assumption	678	41.2		487	29.5		482		29.3	798	38.4		636	30.6		644	31.0		1476	39.6		1123	30.2		1126	30.2
Avoyelles	1758	45.9		1074	28.1		996		26.0	976	37.0		842	31.9		819	31.1		2734	42.3		1916	29.6		1815	28.1
Beauregard	602	50.7		283	23.8		302		25.5	484	39.6		363	29.7		375	30.7		1086	45.1		646	26.8		677	28.1
Bienville	1005	55.7		442	24.5		356		19.8	803	38.8		682	32.9		585	28.3		1808	46.7		1124	29.0		941	24.3
Bossier	921	49.2		521	27.8		432		23.0	1385	28.6		2200	45.5		1252	25.9		2306	34.4		2721	40.5		1648	25.1
Caddo	1515	51.2		832	28.1		614		20.7	2029	34.3		1916	32.4		1966	33.3		3544	39.9		2748	31.0		2580	29.1
Calcasieu	553	48.1		318	27.6		280		24.3	1531	32.6		1561	33.2		1609	34.2		2084	35.6		1879	32.1		1889	32.3
Caldwell	388	45.4		249	29.1		218		25.5	500	39.1		398	31.1		381	29.8		888	41.6		647	30.3		599	28.1
Cameron	216	45.1		157	32.8		106		22.1	311	31.2		358	35.9		328	32.9		527	35.7		515	34.9		434	29.4
Catahoula	730	48.7		418	27.9		350		23.4	370	36.9		308	30.7		325	32.4		1100	44.0		726	29.0		675	27.0
Clabourne	1298	51.4		676	26.8		549		21.8	458	36.0		396	31.2		417	32.8		1756	46.3		1072	28.2		966	25.5
Concordia	636	46.5		401	29.3		331		24.2	313	35.2		298	33.5		279	31.3		949	42.0		699	31.0		610	27.0
DeSoto	1184	50.5		599	25.6		560		23.9	613	38.5		502	31.6		476	29.9		1797	45.7		1101	28.0		1036	26.3
E. Baton Rouge	696	23.7		378	26.8		333		49.5	1180	32.5		1187	32.7		1265	34.8		1876	37.2		1565	31.1		1598	31.7
E. Carroll	959	45.4		633	30.0		518		24.6	158	33.8		160	34.2		150	32.0		1117	43.3		793	30.8		668	25.9
E. Feliciana	846	48.5		511	29.3		388		22.2	292	29.3		373	37.5		330	33.2		1138	41.5		884	32.3		718	26.2
Evangeline	1431	42.5		1049	31.1		891		26.4	874	38.0		707	30.7		719	31.3		2305	40.6		1756	31.0		1610	28.4
Franklin	2293	46.6		1413	28.8		1209		24.6	283	35.9		256	32.4		250	31.7		2576	45.2		1669	29.3		1459	25.5
Grant	480	47.3		288	28.4		246		24.3	685	37.6		565	31.0		573	31.4		1165	41.1		853	30.1		819	28.8
Iberia	675	43.9		443	29.6		397		26.5	1062	36.8		924	32.1		895	31.1		1719	39.3		1367	31.2		1292	29.5
Iberville	329	44.4		212	28.6		200		27.0	1372	37.1		1180	32.0		1142	30.9		1701	38.4		1392	31.4		1342	30.2
Jackson	335	54.8		147	24.0		130		21.2	784	39.3		608	30.5		602	30.2		1119	42.9		755	29.0		732	28.1
Jefferson	100	42.4		79	33.5		57		24.2	817	30.2		908	33.6		979	36.2		917	31.2		987	33.6		1036	35.2
Jeff.-Davis	690	46.3		420	28.2		380		25.5	595	36.0		575	34.8		482	29.2		1285	40.9		995	31.7		862	27.4
Lafayette	1573	45.2		1055	30.3		850		24.5	817	31.7		868	33.7		894	34.6		2390	39.5		1923	31.7		1744	28.8
Lafourche	848	43.6		566	29.1		532		27.3	2101	35.6		1936	32.9		1857	31.5		2949	37.6		2502	31.9		2389	30.5
LaSalle	259	50.2		130	25.2		127		24.6	882	38.3		651	30.0		689	31.7		1091	40.6		781	29.1		816	30.3
Lincoln	933	49.5		556	29.5		397		21.0	684	32.7		886	42.3		524	25.0		1617	40.6		1442	36.2		921	23.2
Livingston	960	43.9		600	27.5		626		28.6	767	30.7		904	36.1		831	33.2		1727	36.8		1504	32.1		1457	31.1
Madison	762	47.0		468	28.9		390		24.1	110	33.7		112	34.4		104	31.9		872	44.8		580	29.8		494	25.4

TABLE III (CONTD.)
AGE COMPOSITION OF OLDER RURAL YOUTH POPULATION
BY RESIDENCE, LOUISIANA, 1952

Parish	Rural-Farm						Rural-Nonfarm						Total											
	15-19 Yrs.			25-29 Yrs.			15-19 Yrs.			20-24 Yrs.			25-29 Yrs.			15-19 Yrs.			20-24 Yrs.			25-29 Yrs.		
	No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent	
Morehouse	1348	46.6		667	23.0	436	32.4	450	33.5	459	34.1	1784	42.1	1329	31.3	1126	26.6							
Natchitoches	1716	50.4	*	813	23.9	971	39.6	748	30.5	732	29.9	2687	45.9	1623	27.7	1545	26.4	*						
Orleans	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*							
Ouachita	673	50.6		296	22.3	1611	36.0	1399	31.2	1471	32.8	2284	39.3	1759	30.3	1767	30.4							
Plaquemines	261	45.1		130	22.5	941	31.7	1019	34.4	1005	33.9	1202	33.9	1206	34.1	1135	32.0							
Pointe Coupee	1117	47.1		597	25.2	608	36.0	559	33.1	520	31.0	1725	42.5	1216	30.0	1117	27.5							
Rapides	1321	47.5		637	23.6	2545	33.2	2462	32.1	2666	34.7	3866	37.0	3265	31.2	3323	31.8							
Red River	775	47.0		406	24.6	307	38.8	238	30.1	246	31.1	1082	44.4	706	28.9	652	26.7							
Richland	1784	46.8		946	24.8	483	33.4	467	32.3	496	34.3	2267	43.1	1552	29.5	1442	27.4							
Sabine	738	48.5		383	25.2	401	26.3	1041	37.7	820	29.7	902	32.6	1779	41.5	1203	28.1							
St. Bernard	43	33.9		47	37.0	598	30.1	669	33.6	723	36.3	641	30.3	706	33.3	770	36.4							
St. Charles	119	41.6		98	34.3	69	24.1	791	36.9	659	30.7	694	32.4	910	37.4	757	31.2							
St. Helena	718	49.6		387	26.8	179	33.5	184	34.4	172	32.1	897	45.3	571	28.8	514	25.9							
St. James	491	41.9		343	29.2	339	28.9	790	39.3	638	31.8	581	28.9	1281	40.3	981	30.8							
St. John	192	45.1		121	28.4	113	26.5	685	35.9	639	33.5	582	30.6	877	37.6	760	32.6							
St. Landry	4325	47.0		2045	22.2	1781	34.8	1681	32.8	1663	32.4	6106	42.6	4512	31.5	3708	25.9							
St. Martin	1233	44.7		714	25.9	934	36.9	850	33.5	750	29.6	2167	40.9	1662	31.4	1464	27.7							
St. Mary	498	39.7		412	32.8	345	27.5	959	39.8	741	30.8	708	29.4	1437	39.8	1153	31.5							
St. Tammany	550	48.4		305	28.9	1013	39.1	815	31.5	762	29.4	1563	42.0	1096	29.4	1067	28.6							
Tangipahoa	2042	44.6		1259	27.5	1446	35.4	1313	32.1	1326	32.5	3488	40.2	2572	29.7	2605	30.1							
Tensas	748	44.6		404	29.5	433	25.9	312	34.4	285	31.4	310	34.2	1060	41.0	779	30.2							
Terrebonne	584	42.0		433	31.1	374	26.9	1793	35.6	1671	33.2	1575	31.2	2377	37.0	2104	32.7							
Union	991	51.1		465	24.0	756	33.4	727	32.2	778	34.4	1747	41.6	1210	28.8	1243	29.6							
Vermilion	1277	44.2		766	26.5	953	37.8	806	31.9	763	30.3	2230	41.2	1650	30.5	1529	28.3							
Vernon	751	49.6		375	24.7	390	25.7	381	29.3	407	31.2	1265	44.9	756	26.8	797	28.3							
Washington	1312	46.7		730	26.0	607	27.3	567	32.1	616	34.8	586	33.1	1879	41.0	1346	29.4							
Webster	914	51.2		470	26.3	402	22.5	1099	33.6	1013	31.0	1158	35.4	2013	39.8	1483	29.3							
W. Baton Rouge	337	41.3		259	31.7	220	27.0	348	34.1	334	32.8	338	33.1	685	37.3	593	32.3							
W. Carroll	1341	47.9		770	27.5	687	24.6	345	36.0	321	33.5	293	30.5	1686	44.9	1091	29.0							
W. Feliciana	438	53.2		226	27.4	482	22.3	857	39.7	822	38.0	920	30.8	1083	36.3	982	32.9							
Winn	516	48.9		237	24.4	282	26.7	348	33.0	326	30.8	898	42.5	605	28.7	608	28.8							
Total	57697	47.0		30308	24.6	51968	35.0	49071	33.0	47586	32.0	109665	40.4	83902	30.9	77894	28.7							

TABLE IV
RACIAL COMPOSITION OF THE OLDER RURAL YOUTH POPULATION
BY RESIDENCE, LOUISIANA, 1950

Parish	Rural-Farm				Rural-Nonfarm				Total			
	White	Non-White	Total	Per-Cent Non-White	White	Non-White	Total	Per-Cent Non-White	White	Non-White	Total	Per Cent Non-White
Acadia	2993	560	3553	15.8	2103	240	2343	10.2	5096	800	5896	13.6
Allen	941	202	1143	17.7	1331	425	1756	24.2	2272	627	2899	21.6
Ascension	1133	491	1624	30.2	1529	817	2346	34.8	2662	1308	3970	32.9
Assumption	908	739	1647	44.9	1281	797	2078	38.4	2189	1536	3725	41.2
Avozelles	2658	1170	3828	30.6	1951	686	2637	26.0	4609	1856	6465	28.7
Beauregard	1139	48	1187	4.0	970	252	1222	20.6	2109	300	2409	12.4
Bienville	774	1029	1803	57.1	954	1116	2070	53.9	1548	2325	3873	60.0
Bossier	583	1291	1874	68.9	3724	1113	4837	23.0	4307	2404	6711	35.8
Caddo	597	2364	2961	79.8	4170	1741	5911	29.5	4767	4105	8872	46.3
Calcasieu	982	169	1151	14.7	3919	782	4701	16.6	4901	951	5852	16.3
Caldwell	575	280	855	32.7	918	361	1279	28.2	1493	641	2134	30.0
Cameron	431	48	479	10.0	899	98	997	9.8	1330	146	1476	9.9
Catahoula	983	515	1498	34.4	669	334	1003	33.3	1652	849	2501	33.9
Claiborne	707	1816	2523	72.0	706	565	1271	44.5	1413	2381	3794	62.8
Concordia	465	903	1368	66.0	508	382	890	42.9	973	1285	2258	56.9
DeSoto	697	1646	2343	70.3	705	886	1591	55.7	1402	2532	3934	64.4
E. Baton Rouge	863	544	1407	38.7	1911	1721	3632	47.4	2774	2265	5039	44.9
E. Carroll	849	1261	2110	59.8	185	283	468	60.5	1034	1544	2578	59.9
E. Feliciana	283	1462	1745	83.8	433	562	995	56.5	716	2024	2740	73.9
Evangeline	2142	1229	3371	36.5	1889	411	2300	17.9	4031	1640	5671	28.9
Franklin	2980	1935	4915	39.4	609	180	789	22.8	3589	2115	5704	37.1
Grant	656	358	1014	35.3	1416	407	1823	22.3	2072	765	2837	27.0
Iberia	852	645	1497	43.1	1841	1040	2881	36.1	2693	1685	4378	38.5
Iberville	488	253	741	34.1	1704	1990	3694	53.9	2192	2243	4435	50.6
Jackson	398	214	612	35.0	1327	667	1994	33.5	1725	881	2606	33.8
Jefferson	231	5	236	2.1	2294	410	2704	15.2	2525	415	2940	14.1
Jeff.-Davis	1307	183	1490	12.3	1162	490	1652	29.7	2469	673	3142	21.4
Lafayette	1885	1593	3478	45.8	2120	459	2579	17.8	4005	2052	6057	33.9
Lafourche	1604	342	1946	17.6	5258	636	5894	10.8	6862	978	7840	12.5
LaSalle	502	14	516	2.7	1899	273	2172	12.6	2401	287	2688	10.7
Lincoln	926	960	1886	50.9	791	1303	2094	62.2	1717	2263	3980	56.8
Livingston	1963	223	2186	10.2	1932	570	2502	22.8	3895	793	4688	16.9
Madison	563	1057	1620	65.2	191	135	326	41.4	754	1192	1946	61.2

TABLE IV (CONTD.)
 RACIAL COMPOSITION OF THE OLDER RURAL YOUTH POPULATION
 BY RESIDENCE, LOUISIANA, 1950

Parish	Rural-Farm				Rural-Nonfarm				Total			
	White	Non-White	Total	Per-Cent Non-White	White	Non-White	Total	Per-Cent Non-White	White	Non-White	Total	Per Cent Non-White
Morehouse	926	1968	2894	68.0	920	425	1345	31.6	1846	2393	4239	56.4
Natchitoches	1423	1981	3404	58.2	1563	888	2451	36.2	2986	2869	5855	49.0
Orleans	*	*	*	*	*	*	*	*	*	*	*	*
Ouachita	761	568	1329	42.7	9772	709	4481	15.8	4533	1277	5810	22.0
Plaquemines	325	253	578	43.8	1861	1104	2965	37.2	2186	1357	3543	38.8
Poincane Coupee	1016	1355	2371	57.1	940	747	1687	44.3	1956	2102	4058	51.8
Rapides	1908	873	2781	31.4	5347	2326	7673	30.3	7255	3199	10454	30.6
Red River	664	985	1649	59.7	471	320	791	40.5	1135	1305	2440	53.4
Richland	2145	1670	3815	43.8	1077	369	1446	25.5	3222	2039	5261	38.8
Sabine	1343	179	1522	11.8	1971	792	2763	28.7	3344	971	4315	22.5
St. Bernard	113	14	127	11.0	1644	346	1990	17.4	1757	360	2117	17.0
St. Charles	175	111	286	38.8	1436	708	2144	33.0	1611	819	2430	33.7
St. Helena	578	869	1447	60.1	315	220	535	41.1	893	1089	1982	54.9
St. James	555	618	1173	52.7	1130	879	2009	43.8	1685	1497	3182	47.0
St. John	180	246	426	57.7	854	1052	1906	55.2	1034	1298	2332	55.7
St. Landry	4287	4914	9201	53.4	3235	1890	5125	36.9	7522	6804	14326	47.5
St. Martin	1496	1263	2759	45.8	1874	660	2534	26.0	3370	1923	5293	36.3
St. Mary	390	865	1255	68.9	1199	1209	2408	50.2	1589	2074	3663	56.6
St. Tammany	907	929	1136	20.2	1685	905	2590	34.9	2592	1134	3726	30.4
Tangipahoa	3455	1125	4580	24.6	2448	1637	4085	40.1	5903	2762	8665	31.9
Tensas	526	1149	1675	68.6	457	450	907	49.6	983	1599	2582	61.9
Terrebonne	808	583	1391	41.9	3801	1238	5039	24.6	4609	1821	6430	28.3
Union	1163	776	1939	40.0	1428	833	2261	36.8	2591	1609	4200	38.3
Vermilion	2565	322	2887	11.2	2122	400	2522	15.9	4687	722	5409	13.3
Vernon	1455	61	1516	4.0	1177	125	1302	9.6	2632	186	2818	6.6
Washington	1857	952	2809	33.9	1231	538	1769	30.4	3088	1490	4578	32.5
Webster	774	1012	1786	56.7	2346	924	3270	28.3	3120	1936	5056	38.3
W. Baton Rouge	327	489	816	59.9	485	535	1020	52.4	812	1024	1836	55.8
W. Carroll	2293	505	2798	18.0	785	174	959	18.1	3078	679	3757	18.1
W. Feliciana	112	712	824	86.4	754	1407	2161	65.1	866	2119	2985	70.9
Winn	823	232	1055	22.0	797	259	1056	24.5	1620	491	2111	23.3
Total	70408	52428	122836	42.7	102424	46201	148625	31.1	172832	98629	271461	36.3

Figure 4 and Table I were prepared to demonstrate the trends in older rural youth population of the state over the last ten years.

When considered as a whole, the older rural youth population decreased by as much as 29.7 per cent from 1940 to 1950. The breakdowns by residence groups are more revealing as to the migrants from rural areas. The number of older youths living in rural-farm areas decreased by almost one-half (47.9 per cent) in the ten-year period under study. Even with allowance made for the low birth rates of the 1930's this figure is so large as to be almost unbelievable. In this regard, the meaning of the above in terms of the future of the rural-farm population is a question worth pondering. One might speculate that continuation of this trend could well mean a dearth of persons to take over our farms within the very near future. One inference is that farm life is just not attractive enough to hold the younger generation to the soil. All in all, the planners concerned with the future of agriculture have a critical task at hand. The rural-nonfarm youth population just about held its own during the period 1940 to 1950, registering a loss of only 1.3 per cent.

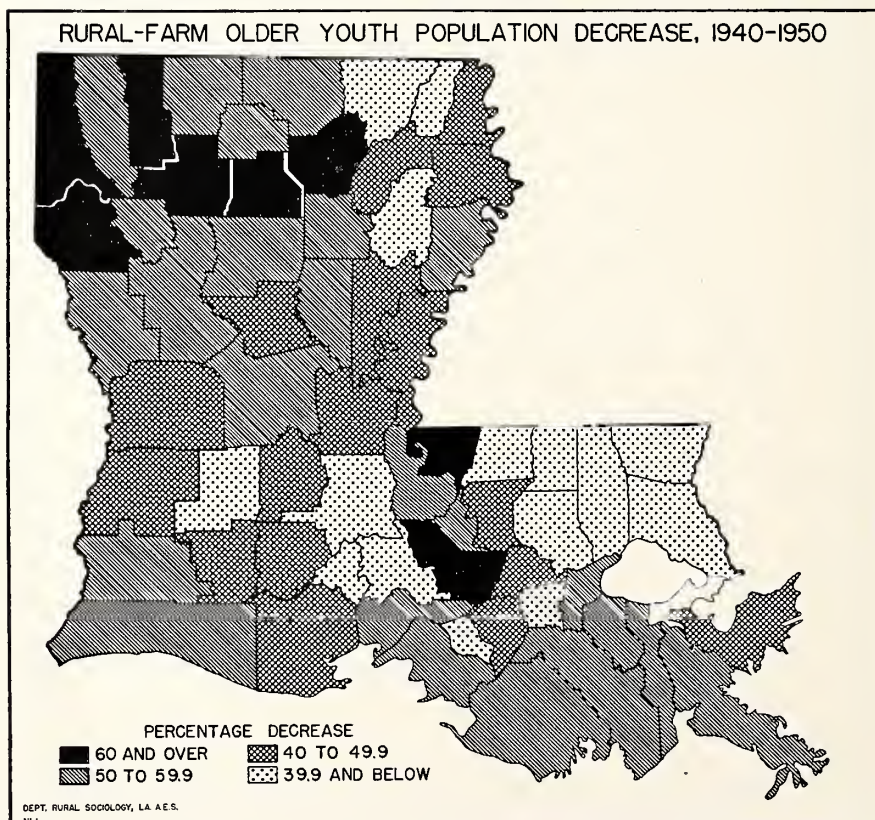


FIGURE 4. Rural-farm older youth population change in the parishes of Louisiana, 1940 to 1950. (Source of data: Seventeenth Census of the United States.)

Certain areas of the state give indication of having lost more of their older rural-farm youth population than others. With the exception of West Feliciana and Iberville the parishes suffering the heaviest loss are in the northwest and north central parts of the state. The extreme southeastern parishes and the central Louisiana parishes rank next in this respect. The least loss in this population group was experienced by the Florida parishes and the Mississippi Delta cotton parishes. Twenty-four of the state's parishes registered decreases in their rural-nonfarm older youth population, while the remainder registered increases. As has been noted the numerical superiority of the parishes showing decreases accounted for a slight drop in the total rural-nonfarm older youth population. Very little can be seen in the way of spacial patterning in the trends reported above except that parishes with towns and cities tend to have their nonfarm youth population increase.

SELECTED ASPECTS OF SOCIAL PARTICIPATION

It has been demonstrated that participation in formal groups is one of the best means of attaining a well-rounded personality, as well as one of the best forms of training in citizenship and democracy. The person who assumes a place of responsibility in clubs and other associations gains not only valuable experience but a great deal of personal satisfaction. It is thus safe to say that the more experience of this nature the individual has, the more self-confidence, greater sense of security, and greater sense of belonging to the community is likely to be developed by him. More important from the planners' point of view is the fact that participation gives the first indication of the likely extent of a given youth's useful citizenship.

Obviously the complete story of the participation of Louisiana rural youth cannot be told at the present time. In the first place, the information has not been collected. In the second, it is doubtful if any one study could be so ambitious as to propose to cover every facet of the complex lives of these youths. To get the whole picture one would have to add the social participation of an informal nature to that of all types of organized groups, not just one or two types. It is hoped, however, that the reader will leave this limited view with a clearer understanding of the participation and interest of older rural youth in educational and recreational programs. This was the aim which set the limits to the data collected.

Three considerations were kept in mind in planning this part of the study. The first was the need for information relative to the interest of rural youth in formal programs. The second was the desirability of information on the motivation of this group to join formal associations, especially those of an educational nature. The final aim was the determination of older rural youths' experience with formal educational and recreational programs outside the schools. The relevant findings in connection with each of these objectives is discussed below.



The far-sighted community will encourage its older youth to take an active part in community affairs . . .



. . . and plan the right kind of recreational outlet for them.

Interest in Formal Programs

When the administrator of an action program finds himself in a position of planning for a particular group, his first concern is the group's motivation to participate in what he has to offer. If interest is already kindled his task is lightened manifold. On the other hand if he has the problem of creating enthusiasm as well as that of the presentation of his materials in an attractive form, his work is more than doubled. In order to determine what interest older youth of the state might have in informational and recreational programs each interviewee was asked, "Would you participate in educational and/or informational and social and/or recreational programs designed for young men and young women in your community?"

The responses received to the above query are extremely significant for all who have interest in this group. Almost nine out of every ten (88.6 per cent) indicated they had definite interest in programs of the above type. (See Table V.) The majority of the remainder (6.4 per cent) were undecided as to whether or not they would participate and only 5.0 per cent definitely said they would not be interested in or participate in such activity. The keen interest of the young people interviewed is manifested in the remarks they made when responding to the above question. Such statements as "I would be very glad to give full cooperation to such programs" and "Young people in this area have long needed to have a place where they could meet one another and learn things" were voiced with an earnestness which bespoke their sincerity.

TABLE V
Expressed Interest of Older Youth Interviewed in Informational and
Recreational Programs, Six Survey Parishes, Louisiana, 1952

Interest	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Yes	227	90.7	271	87.4	498	88.6
No	12	4.7	16	5.2	28	5.0
Undecided	13	5.2	23	7.4	36	6.4
Total	252	100.0	310	100.0	562	100.0

There was no great difference in the proportions of young men and women expressing interest in the above type programs. Apparently both sexes have approximately the same feelings on the matter. Another interesting discovery is the fact that there were no significant areal variations in responses. In view of this, one is led to conclude that culture, type of farming, and other variables have little significance when older youth of Louisiana face the problem of finding suitable opportunities for activity of an educational and recreational nature.

Extent of Participation in Organized School Groups

Presumably all students in various school situations have the same opportunity to participate in organized group activity of one kind or

another. It follows that a tabulation of those having participated in such groups will shed light on the proportion of students with a motivation for organized activity. In other words it is logical to assume about the same relative number of persons who exhibit interest in organizational life while in school will be inclined to such participation outside school. Such knowledge has obvious use for the Extension or other planner for older rural youth.

According to interviewees' responses almost three out of every four of them had belonged to at least one organized group connected with the school they had attended or were attending. Interestingly, of the total number of persons having taken part in formal organizations, almost as many had belonged to two clubs as had belonged to one. (See Table VI.) This finding supports the hypothesis that individuals joining clubs usually have strong motivations to participate in organized group life. In this connection, it is of interest that one out of ten of the interviewees belonging to clubs had been a member of as many as three different organizations. A few (3.9 per cent) held membership in four or more groups of this kind.

On the other side of the picture, it is worthy of note that as high a proportion as 26.2 per cent of the older rural youth interviewed had had no experience of the above type. Whether this lack of participation reflects a lack of opportunity or disinterest was not determined. However, the fact that many students of their age had belonged to more than one club suggests the latter reason had considerable bearing on their lack of membership. Whatever the reason, this portion of older youth will be a challenge to persons interested in reaching them with educational programs in that their social participation experience is thus limited.

TABLE VI
Participation of Older Youth Interviewed in School Clubs and Other
Organizations, Six Survey Parishes, Louisiana, 1952

Number of Organizations Belonged To	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
None	76	30.2	71	22.9	147	26.2
One	76	30.2	111	35.8	187	33.3
Two	78	30.9	78	25.2	156	27.7
Three	18	7.1	32	10.3	50	8.9
Four or More	4	1.6	18	5.8	22	3.9
Total	252	100.0	310	100.0	562	100.0

The discovery that girls are more inclined to belong to organized groups than boys is an important one. The data obtained indicates that only 22.9 per cent of the girls interviewed as compared with 30.2 per cent of the boys interviewed did not join a single school club. The significance of this finding lies in the indication that girls will be easier to reach with educational and informational programs of various kinds.

In closing this section, it may be noted that the interviewees participating in school clubs were quite active in this connection. (See Table VII.) As many as 40.7 per cent indicated they had a leadership role, at one time or another, in their organizations. An additional 36.1 per cent indicated by their regular attendance and interest that they were very active members. One out of five (20.5 per cent) were nominal members in that they did little more than attend meetings frequently. Only 2.7 per cent said they were members in name only as they seldom attended meetings or other functions of the clubs to which they belonged.

Table VII

Role of Older Youth Interviewees in School Clubs and Other Organizations,
Six Survey Parishes, Louisiana, 1952

Usual Type of Participation	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Leadership Role	70	39.8	99	41.4	169	40.7
Very Active Member	65	36.9	85	35.6	150	36.1
Active Member	37	21.0	48	20.1	85	20.5
Inactive Member	4	2.3	7	2.9	11	2.7
Total	176	100.0	239	100.0	415	100.0

Participation in Educational Programs Outside the School

As aforementioned, a tabulation of the number of interviewees taking part in organized efforts to improve their knowledge outside the school was made. (See Table VIII.) The most important fact to emerge from these tabulations is that one-fourth of the sample population had experience of this nature. Above everything else this knowledge indicates that a substantial proportion of older youth are willing to take advantage of opportunities made available to them. This knowledge, in turn, justifies such programs. It is conceivable that a program which takes cognizance of their especial needs and interests would be backed by a much larger proportion of the older youth population. This may be interpreted as both challenging and encouraging to those persons in a position to be of such assistance.

TABLE VIII

Participation of Older Youth Interviewed in Community Clubs and Other
Organizations of an Educational Nature, Six Survey Parishes,
Louisiana, 1952

Number of Organizations Belonged To	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
None	192	76.2	231	74.5	423	75.3
One	44	17.4	55	17.7	99	17.6
Two	15	6.0	21	6.8	36	6.4
Three	1	0.4	3	1.0	4	0.7
Four or more	0	....	0	....	0	....
Total	252	100.0	310	100.0	562	100.0

Participation in Recreational Activity

From the standpoint of the number of activities listed, the older youth in rural areas of the state enjoy a wide variety of pastimes. No less than six major types of activities were reported by older youth in response to a query directed toward finding out the nature of their leisure time activity. As might be expected, the most popular recreation, in terms of the number of persons reporting participation, was the movies. Of the 558 persons responding to the question under consideration, 539 (96 per cent) reported this activity as one they had used for purposes of recreation. It may be noted that there was no significant difference between the sexes in the proportions reporting this activity. One wonders how, in this day and time, it is possible for anyone to steer completely clear of the movies for as long a time as a year. In this regard, apparently the 19 interviewees who did not go to the movies did not do so because of religious interpretations rather than on account of isolation.

Outdoor sports, such as hunting and fishing, were second in popularity as a recreational outlet for the older youth interviewed. This is to be expected from a group of ruralites. It is also not surprising to discover that boys are much more interested in this type of recreation than are girls. The data in Table IX show that practically all of the boys (99.6 per cent) indulged in this kind of pastime. Although they do not participate in such sports as much as boys, rural girls are not adverse to outdoor activities. As many as 57.7 per cent of them reported participation in recreational activity of this sort. Perhaps of greatest significance to the planner is the fact that three-fourths of all the interviewees said they had indulged in recreation of this nature.

TABLE IX
Recreational Activities Reported by Older Youth Interviewees,
Six Survey Parishes, Louisiana, 1952

Activity	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Dances	111	44.0	124	40.0	235	41.8
Other Parties	108	42.8	164	52.9	272	48.4
Movies	244	96.8	295	95.2	539	95.9
Spectator Sports	170	67.5	176	56.8	346	61.6
Outdoor Sports	251	99.6	179	57.7	430	75.5
Church Parties	30	11.9	37	11.9	67	11.9
No Response	0	....	4	1.3	4	0.7

Spectator sports ranked third in terms of popularity as a form of recreation for rural youth. Over three out of five of them had attended some kind of a game during the year. Here again a larger percentage of the boys (67.5 per cent) than of the girls (56.8 per cent) reported participation of this kind. The latter finding would be expected, however, because of the fact that more boys participate in such sports.

Fourth in importance as a recreational outlet for the group under study, according to their responses, are parties other than those associated

with the church. Almost one-half of the total number of interviewees reported attendance at functions of this sort. In this instance girls indicated a greater degree of participation (52.9 per cent) than did boys (42.8 per cent). No doubt girls have more occasion to get together in this manner than do boys.

To the uninitiated it may seem puzzling that only 41.8 per cent of the interviewees indicated they had attended a dance during the past year. This is easily explained, however, in terms of the religious culture dominant in north Louisiana. A slightly greater proportion of the boys (44 per cent) than of the girls (40 per cent) reported recreational activity of this nature.

Church parties were in sixth place, with respect to the number of persons reporting participation in them. A sizeable group (11.9 per cent) attended this type of a recreational function, however. Interestingly, exactly the same proportion of boys as girls took part in church socials.

PREFERENCES AND CUSTOMS WITH RESPECT TO EDUCATIONAL AND RECREATIONAL PROGRAMS

The researcher can go a long way toward assuring the success of a program by furnishing its administrators with two types of information. The first and most obvious type is in connection with the desire of the population under study in the way of education, recreation, and so on. The second type, often called the mechanical aspects of programming, is the one most often overlooked by researchers. It includes knowledge of the time, place, and kind of presentation favored by the group the program hopes to reach. The significance of both types of knowledge should be readily apparent. In fact, although it may be known what is wanted in the way of information and recreation, the success of a particular effort to disseminate this material to the group will be directly correlated to the attractiveness of the program in its mechanical aspects. It is thus that an attempt was made to collect data both on the kinds of programs in which older youth are interested and the manner, place, and time they wish to have the information presented to them.

Educational Programs

It has already been demonstrated that the older rural youth of Louisiana are interested in educational programs. In this connection it may be noted that youth everywhere have a surplus of energy. It would seem, then, that programs of this nature could not help but succeed. However, the experienced person knows that this interest and energy cannot be channeled or directed except by the most skillful and informed leaders. The information below is presented in an attempt to make the task of these leaders easier.

Topics of Interest to Older Youth

The query, "What educational and informational topics are you especially interested in?" was posed to every interviewee. Although the

question was asked in such a way as to enable the individual respondent to specify the particular topic in which he or she was particularly interested, all specific answers were grouped under major headings for the purpose of this analysis. Close scrutiny of the data in Table X reveals an interesting phenomenon. Considerably more boys (36.9 per cent of the sample population) than girls (11.3 per cent of the sample population) did not list any particular topic as being of primary interest to them. This, in turn, set the stage for the topics of primary interest to girls to be unduly weighted in a combined tabulation. The reason why so many boys do not have specific things in mind for discussion is difficult to determine. This is especially true in view of the fact that they indicated a felt need for programs of the kind about which they were questioned. Apparently they have not reached the particular stage in their life where they have made vocational and occupational choices and thus have not come face to face with situations where they needed more exact information. Girls, on the other hand, are pretty certain of their future life and thus have given more thought to what they would like to know.

Of the 287 interviewees indicating an interest in topics dealing with the home and family, 240 were girls. This ratio is probably near what would be expected in view of the nature of this topic. The fact that as many as 47 boys said they had primary interest in topics of this sort is significant in that it indicates they are not unaware of needing information of this nature. It might be of interest to note that such specialized items as child care, interior decorating, flower gardening, and mate selection were among those singled out for discussion under this heading.

TABLE X

Number of Older Youths Expressing Interest in Particular Educational and Informational Topics, Six Survey Parishes, Louisiana, 1952

Subject	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Home and Family	47	18.6	240	77.4	287	51.3
Farm and Business	125	49.6	48	15.5	173	30.8
Personal Problems	4	1.6	10	3.2	14	2.5
Other	15	6.0	18	5.8	33	5.9
No Particular Preference	93	36.9	35	11.3	128	22.8
Total	252	*	310	*	562	*

*Totals in these instances equal more than 100 per cent because a number of interviewees indicated interests in more than one topic.

Three out of ten of the older youth wanted to learn more about farming and business ventures. Boys (125 of them as compared with 48 girls) showed considerably more interest, of course, in topics classifiable under this heading. Again, however, it may be noted that interests of older youth are broad enough to cut through the whole gamut of subject matter associated with occupational and domestic life, regardless of sex. The two specific topics under the above heading most often singled out

as of major importance by older youth interviewees were problems of farm management and those in connection with the growing and care of livestock.

Relatively few persons (2.5 per cent) listed educational subjects classifiable under the broad heading of personal problems as matters needing special attention. In view of the apparent concern of older youth with such problems (shown elsewhere), this fact could be taken as inconsistent. There are, however, at least two factors which might account for it. In the first place, the interviewees may have interpreted such problems as not being the sort of thing to discuss in an open meeting. In the second place, it is probable that many of them did not feel they were "good" topics in comparison with discussion subjects others in the community might desire. Whatever the reason, it is certain that there is more interest in topics of this nature than the above small percentage would lead one to believe.

The remainder of the responses in connection with subjects which would be of interest were quite varied. They included suggestions for programs dealing with music appreciation, artistic expression, book reviews, and the like. Altogether 5.9 per cent of the interviewees named such miscellaneous topics as worthy of inclusion in educational programs.

In concluding this section at least two analytical observations are in order. The first seems to be the fact that older youth, while keenly aware of a need for such educational programs, are not quite sure with which topics these programs should deal. This deduction comes from the large percentage of interviewees not listing any particular subject preference. The second conclusion is more evident. It is that home life and occupational pursuits are important in the minds of persons in this age group. Both these observations are pertinent in terms of a better understanding of the mental complex of older rural youth.

Opinion as to the Size and Composition of Participating Group

In an effort to determine the social group situation in which older youth would perform best with respect to educational programs, interviewees were asked to give their opinion on this matter. An attempt was made to phrase the interrogation in such a way as to minimize misinterpretation. With this factor in mind, the respondents were asked to select the locality grouping they thought best suited for educational programs for older youth. In this way their thinking in terms of the composition of the group was also brought into the picture. Thus persons who would not feel at ease among strangers would most likely select the smallest locality group, i.e., the neighborhood, as the ideal area from which to solicit participants. The data regarding this question appear in Table XI.

It is a commentary on the rational thinking of older youths that the majority (55 per cent) of the persons interviewed suggested the community as the ideal locality area from which to recruit persons for formal

educational programs. It may be noted that the term "community" as defined to the interviewees included the cluster of surrounding neighborhoods which they normally considered as belonging to the same school, trade center, or other such symbol of unity. No doubt this is the size group which would be most manageable, both in the number of people that would be involved and in the *esprit de corps* which could be maintained.

TABLE XI

Opinion of Older Youth Interviewed with Respect to the Maximum Population Grouping Suitable for Educational and Informational Programs, Six Survey Parishes, Louisiana, 1952

Opinion	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Neighborhood	52	20.6	74	23.9	126	22.4
Community	138	54.8	172	55.5	310	55.1
Parish	56	22.2	56	18.0	112	20.0
No Particular Opinion	5	2.0	3	1.0	8	1.4
No Response	1	0.4	5	1.6	6	1.1
Total	252	100.0	310	100.0	562	100.0

It is interesting that almost the same proportion of respondents were of the opinion that the neighborhood group (22.4 per cent) as the entire parish (20.0 per cent) was the locality from which to draw participants. The inference is that groups of this size might be considered in particular situations or for particular programs. Certainly some programs lend themselves to individualized instruction better than others that are more general in their appeal.

Sex differentials are not exceptionally pronounced in this instance. Just about the same proportion of boys as of girls expressed preference for programs on a community basis. A slightly larger percentage of girls (23.9 per cent as compared with 20.6 per cent) favored the neighborhood as the place from which to recruit participants. In contrast a slightly higher percentage of boys (22.2 per cent as compared with 18.0 per cent) expressed the belief that the parish was the more ideal areal base from which to draw persons as participants in educational programs.

Preferences with Respect to the Technique of Presenting Information

There are several techniques which may be used in the dissemination of educational material. Depending on their particular learning capacities and habits, individuals profit more from one or the other of these methods. In this connection it may be noted that the Agricultural Extension Service has had more success with what is called the demonstration method than with any other. Significantly, the validity of their approach is borne out by the expressed preferences of the older youths interviewed. (See Table XII.)

Well over half of the sample population (54.4 per cent) definitely favored programs using the demonstration technique. Although sex dif-

TABLE XII

Preferences Expressed by Older Youth Interviewed for Specific Methods of
Presenting Educational and Informational Programs,
Six Survey Parishes, Louisiana, 1952

Preference	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Lecture	29	11.5	24	7.7	53	9.4
Group Discussion	74	29.4	91	29.4	165	29.4
Demonstration	130	51.6	176	56.8	306	54.4
Combinations of the Above	5	2.0	7	2.3	12	2.2
Reading Material	1	0.4	1	0.3	2	0.4
No Particular Preference Voiced	13	5.1	11	3.5	24	4.2
Total	252	100.0	310	100.0	562	100.0

ferentials in preferences were not great, girls were slightly more inclined to prefer this approach. Second in order of preference, and favored by 29.4 per cent of the group, was the group discussion technique. This percentage is high enough to indicate more than passing appreciation for the effectiveness of this approach. Interestingly, exactly the same percentage of boys as of girls indicated a preference for this type program.

The only other technique to receive anything like a significant vote was the lecture. One out of every ten persons queried (9.4 per cent) felt this to be their first choice for the presentation of educational material. Of interest is the fact that boys were somewhat more favorable to this method than were girls. The two other techniques mentioned were combinations of lecture, group discussion, and demonstration (2.2 per cent); and reading and other visual aids (0.4 per cent). A few persons (4.2 per cent) did not express any particular preference in this connection.

Day-of-Week Preferences

In most societies custom designates certain days as most appropriate to engage in particular kinds of activities. So deeply entrenched do these patterns of behavior become that those who ignore them in planning certain kinds of activities stand to meet with discouragement in the form of non-attendance. For this reason it was deemed important to find out what particular days older youths thought best for educational programs.

The most significant discovery, in the above respect, seems to be that over one-fourth of the persons interviewed had no particular day-of-the-week preference for educational programs. Sex variations are not important in this particular response as approximately the same percentage of boys and girls indicated they had no preference for a particular day or days. This indicates that such programs are not traditionally associated with particular days by older youth and therefore operate with a greater flexibility than most.

Of the persons making a selection of the particular day of the week on which they preferred to attend educational programs, about the same

relative number selected Wednesdays, Fridays, and week ends. (See Table XIII.) Monday, Tuesday, and Thursday are the three days which would meet with less success in this respect, with Tuesday being the least desirable of all days.

TABLE XIII
Older Youth Interviewees' Day Preferences for Educational Programs,
Six Survey Parishes, Louisiana, 1952

Day of Week	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Monday	16	6.3	14	4.5	30	5.3
Tuesday	18	7.1	28	9.0	46	8.2
Wednesday	36	14.3	59	19.0	95	16.9
Thursday	13	5.2	31	10.0	44	7.8
Friday	41	16.3	47	15.2	88	15.7
Week Ends	50	19.8	37	11.9	87	15.5
No Preference	69	27.4	81	26.2	150	26.6
No Response	9	3.6	13	4.2	22	3.9
Total	252	100.0	310	100.0	562	100.0

In connection with the above, the preferences of girls differed somewhat from that of boys in that considerably more of them (19.0 per cent as compared with 14.3 per cent) said they would prefer to have such programs come on a Wednesday night. In contrast more boys (19.8 per cent as compared with 11.9 per cent) preferred week-end days. Interestingly, quite a few more girls, relatively speaking, thought Thursday night the ideal time to have educational programs (10.0 per cent of them as compared with 5.2 per cent of the boys).

It is possible to draw some important inferences from the above data. First, older youth have not been conditioned to look for educational programs on any particular day. Thus planners would be safe in working such events into the weekday routines already known to be established. In this respect Wednesdays and Fridays probably would be the best days because a greater proportion of interviewees felt that on these days there would less likely be a conflict with other activities.

Time-of-Day Preferences

Undoubtedly older youth are inclined to prefer evening meetings, insofar as educational programs are concerned, to those held at any other time. Almost two-thirds of the interviewees (64.2 per cent) voiced the wish that such programs be held in the evening. The fact that almost the same proportion of both sexes (67.9 per cent of the boys as compared with 61.3 per cent of the girls) felt this time to be best is further evidence in favor of holding meetings at night. Table XIV shows that 17.4 per cent of the respondents (largely girls) stated they would be in favor of afternoon meetings. Although this fact is significant in some ways this percentage is hardly large enough to warrant more than an occasional meeting at this time. Perhaps a program especially for girls would be success-

ful as an afternoon endeavor. Very few persons (4.4 per cent) said they would like to have morning meetings. Ten per cent of the interviewees had no preference in regard to time of day of meetings.

TABLE XIV

Older Youth Interviewees' Time-of-Day Preferences for Educational Programs,
Six Survey Parishes, Louisiana, 1952

Time of Day	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Morning	12	4.7	13	4.2	25	4.4
Afternoon	35	13.9	63	20.3	98	17.4
Evening	171	67.9	190	61.3	361	64.2
No Preference	26	10.3	30	9.7	56	10.0
No Response	8	3.2	14	4.5	22	4.0
Total	252	100.0	310	100.0	562	100.0

The social planner, in view of the above, would certainly be foolish to schedule the majority of his meetings at a time other than in the evening. This discovery poses a serious problem in terms of the work hours for Extension and for other such programs. Professionals understandably hesitate to use their own leisure time in this type of endeavor. As a matter of fact this dilemma was pointed out by persons active in older youth work who maintain it is impossible continually to do a good job at night after spending the day in an office. The solution to this problem seems to be recognition of the above by administrative authorities. Once its meaning is realized, arrangements either for extra pay or compensatory time off would encourage professional workers in these efforts. Whatever the solution decided upon, this is a problem that needs careful investigation.

The Use of Informal Means of Education

In this day and age modern means of communication are increasingly utilized as a means of disseminating information to the public at large. It is thus that many persons such as county agents have felt a keen need of information relative to the use of such means by their clientele. Because it was felt that there would be some benefit in knowing what experience older rural youth had had with informal types of learning, each interviewee was asked, "Have you used the radio, TV, newspapers, or other periodicals as a source of information?" The responses to this question were tabulated and appear below in Table XV.

Thirty-nine individuals (20 boys and 19 girls; 6.9 per cent of the sample population) indicated that radio or TV programs were their only sources of informal education outside of word of mouth. An additional 15.7 per cent of the persons interviewed said they had used newspapers and periodicals exclusively for such informal learning experiences. Over one-third (34.0 per cent) of the youth questioned responded that they had used both as sources of educational information.

When the above percentages are added together one learns how effective informal means of teaching are in reaching even a select rural audience. Over half (56.6 per cent) of the youth interviewed definitely felt they raised their level of information by paying attention to the transmitted or written word. In this connection it is safe to assume that a substantial amount of information is taken in without the individual's becoming aware of it because of the informality of the situation. The conclusion that youth can be reached in this way is evident, however. In this regard one may speculate that trends in the distribution of radios, newspapers, and so forth, plus the increasing awareness of the value of these devices on the part of individuals, will mean more success in terms of spreading useful knowledge in the future.

TABLE XV

Sources of Informal Education Outside Word of Mouth of Older Youth Interviewed,
Six Survey Parishes, Louisiana, 1952

Source	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Radio and T.V. Only	20	8.0	19	6.1	39	6.9
Newspapers and Periodicals Only	38	15.1	55	17.8	88	15.7
Combinations of the Above	85	33.7	106	34.2	191	34.0
No Such Source of Information	57	22.6	76	24.5	133	23.7
No Response	52	20.6	54	17.4	106	18.9
Total	252	100.0	310	100.0	562	100.0

Recreational Programs

Those studies which concern the differential between the recreational activity-wishes of older rural youth and their satisfaction have come up with a very disturbing conclusion. Almost without exception the discrepancy between the organized recreational outlets and the needs of young people is of tremendous proportions in rural areas. These findings present a challenge to every rural community. The information below is presented in the hope that it will be of help in meeting this challenge.

Recreational Activity Enjoyed

In an attempt to find the types of activities which might provide primary recreational outlets for older rural youth, each interviewee was asked, "What type of social or recreational program especially appeals to you?" The question was put in this manner rather than in the nature of what might be thought best for older youth in general to minimize personal interpretation in the responses. The answers to this question are summarized in Table XVI.

The extent to which sports have become a part of life even in the rural parts of the United States is shown by the large number of persons

listing this sort of entertainment as being preferred by them. Almost one-fourth (24.9 per cent) of the older youth interviewed listed spectator sports as their first choice of recreational activity. It is pertinent to note that while boys had considerably more interest in witnessing sport events, girls were by no means disinterested. This is shown by the fact that one-third of the boys as compared with 18.4 per cent of the girls named this activity as their first choice for a recreational outlet. Nearly as many youths (22.4 per cent) said they preferred taking part in outdoor sports, such as games, fishing, and hunting. One would, of course, expect a group of rural dwellers to show more appreciation for the latter kind of activity. However, the fact that almost one-half of the interviewees named sports in one way or another is most enlightening. Proportionately fewer girls (13.9 per cent as compared with 33.0 per cent of the boys), yet still a substantial number, selected outdoor sports as their first choice for recreation.

TABLE XVI
Older Youth Interviewees' First Choice of Recreational Activity,
Six Survey Parishes, Louisiana, 1952

Activity	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Dances	31	12.3	74	23.9	105	18.7
Other parties	16	6.3	37	11.9	53	9.4
Movies	30	11.9	63	20.3	93	16.6
Spectator Sports	83	33.0	57	18.4	140	24.9
Outdoor Socials	4	1.6	23	7.4	27	4.8
Outdoor Sports	83	33.0	43	13.9	126	22.4
No Response	5	1.9	13	4.2	18	3.2
Total	252	100.0	310	100.0	562	100.0

Worthy of note is the fact that almost one-fifth of the interviewees named dancing as their most enjoyable type of recreation. With regard to this activity it is interesting that girls manifested more interest than boys. Twenty-three per cent of the former as compared with 12.3 per cent of the latter named this activity as their favorite form of recreation. It may be noted that the proportion of interviewees selecting this pastime varied considerably from area to area. This phenomenon, as has been mentioned, is explained in terms of the variations in the religious composition of the population of the state.

Almost as many persons named movies as their first choice of recreation as chose dancing. About one-sixth of the persons interviewed singled out this activity as their first choice for entertainment. Interestingly, girls showed more inclination to be partial to this activity than did boys. As many as one-fifth of the young women as compared with just over one-tenth of the young men named movie-going as their first recreational choice.

Slightly less than one-tenth of the youth indicated they enjoyed indoor parties more than any other type of recreation. Again, as might

be expected, the total percentage is weighted somewhat by a larger proportion of girls with such a preference. A few persons (4.8 per cent of the total) expressed a preference for outdoor socials of one kind or another.

From the above it is possible to infer that rural youth have varied recreational interests. Their specific preferences, however, are definitely in the direction of activity of the type calling for individual participation. This perhaps is one of the most significant findings in terms of community planning.

Opinion as to Size and Composition of Participating Groups

Recreational programs, as a rule, require even more of an "in-group" situation than do educational programs. It is of importance to know what social group older youth consider as belonging to their intimate social circle. When asked which locality group they felt to be ideal for planned recreational programs, about twice as many youth named the community as did the neighborhood or parish. (See Table XVII.) The comparative percentages are as follows: the community, 54.8 per cent; the neighborhood, 20.8 per cent; the parish, 21.9 per cent. Indication that all felt rather strongly on this point is found in the small number (1.4 per cent) having no particular opinion on the matter. Interestingly, there is very little difference in the proportions of boys and girls voicing specific opinions.

TABLE XVII

Opinion of Older Youth Interviewed with Respect to the Maximum Population Grouping Suitable for Social and Recreational Programs,
Six Survey Parishes, Louisiana, 1952

Opinion	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Neighborhood	52	20.6	65	21.0	117	20.8
Community	136	54.0	172	55.4	308	54.8
Parish	58	23.0	65	21.0	123	21.9
No Particular Opinion	5	2.0	3	1.0	8	1.4
No Response	1	0.4	5	1.6	6	1.1
Total	252	100.0	310	100.0	562	100.0

Day-of-Week Preferences

With respect to the time of the week thought best for recreational programs, the older youth interviewed were in fair agreement that the week-end days are the most suitable. (See Table XVIII.) This finding is in line with traditional rural folkways and patterns of work activity. Only a very small proportion of boys and girls selected the first four days of the work week as good for recreational activity. In contrast, almost half of the sample population were of the opinion that Fridays and Saturdays were the best days for such functions. The large number (25.8 per cent) of interviewees saying they had no preference for a day of the week in this respect reflects the fact that many interviewees had no occupa-

tional or school commitments. Nevertheless the inference remains that recreational programs will meet with more success on week ends.

TABLE XVIII

Older Youth Interviewees' Day Preferences for Social and Recreation Programs,
Six Survey Parishes, Louisiana, 1952

Day of Week	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Monday	6	2.4	9	2.9	15	2.7
Tuesday	8	3.2	6	1.9	14	2.5
Wednesday	20	7.9	25	8.1	45	8.0
Thursday	23	9.1	37	11.9	60	10.6
Friday	45	17.9	65	21.0	110	19.6
Weekends	78	30.9	76	24.5	154	27.4
No Preference	66	26.2	79	25.5	145	25.8
No Response	6	2.4	13	4.2	19	3.4
Total	252	100.0	310	100.0	562	100.0

Time-of-Day Preferences

The great majority of the interviewees preferred that recreational programs occur in the evening rather than in the morning or afternoon. Almost three-fourths of the total number of persons questioned named the evening as the best time. (See Table XIX.) Such a discovery is not surprising in view of traditional recreational practices. It may be noted, however, that certain types of recreational programs, such as outdoor socials and sports, would need to be held during daylight hours. The great interest manifested in activity of this kind suggests the need for balanced planning in terms of time and types of activity.

TABLE XIX

Older Youth Interviewees' Time-of-Day Preferences for Recreational Programs,
Six Survey Parishes, Louisiana, 1952

Time of Day	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Morning	4	1.6	4	1.3	8	1.4
Afternoon	23	9.1	39	12.6	62	11.0
Evening	193	76.6	218	70.3	411	73.2
No Preference	24	9.5	35	11.3	59	10.5
No Response	8	3.2	14	4.5	22	3.9
Total	252	100.0	310	100.0	562	100.0

Selected Information Related to Program Planning

In trying to round out the information deemed pertinent to programmers for rural youth, several questions were asked which for the most part apply equally well to either educational or recreational types of programs. The responses to these queries are included as an adjunct to the material given in the two previous discussions.

Preferences with Respect to Joint Educational and Recreational Programs

There has been much discussion as to the merits of combining formal educational programs with recreational activity of one kind or another. Proponents argue that more people are attracted to combined meetings with the result that these render a greater service. Those not in favor of combined programs say that persons with no motivation to attend educational programs will not expend the necessary effort to profit from their incidental exposure to them. Regardless of the validity of either school of thought, the older youth interviewed leave no doubt as to their particular preferences. (See Table XX.)

TABLE XX

Older Youth Interviewees' Preferences with Respect to Combined Educational and Recreational Programs. Six Survey Parishes, Louisiana, 1952

Expressed Preference	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Favorable to Combined Programs	173	68.6	221	71.3	394	70.0
Unfavorable to Combined Programs	68	27.0	70	22.6	138	24.6
No Preference	5	2.0	5	1.6	10	1.8
No Response	6	2.4	14	4.5	20	3.6
Total	252	100.0	310	100.0	562	100.0

As many as 70 per cent of the persons questioned favored combined programs. It is significant that only minor differences appear in the relative number of boys and girls expressing this preference. The strong minority (24.6 per cent) reacting unfavorably to combined programs cannot be overlooked, however. It is interesting that a relatively higher proportion of the boys (27.0 per cent as compared with 22.6 per cent of the girls) were of the opinion that such programs should be separated. Perhaps this indicates that boys are more inclined to be serious-minded in their quest for knowledge.

All in all, the implication of the interviewees' responses to the above question seems clear enough. For the most part they will cooperate more willingly in combined programs. Nevertheless the social planner will have to make allowance for the minority (depending on their number and vocal strength) in his area.

Availability of Transportation

In rural areas the question of transportation is always a very real one. At the very least the ruralite must put out a great deal more effort to participate in group activities than the urbanite. No doubt many community functions are neglected because of a lack of transportation. It is vital to know something about the facilities of this nature available to youth.

The discovery that nine out of every ten of the youth interviewed had some kind of transportation available for attending meetings away from home is encouraging. (See Table XXI.) On the other hand the ten per cent not so fortunate point up a real problem to the persons concerned with reaching them. This is especially true because of the likelihood that this group is the one most in need of a fuller social life. In other words the chances are that the more underprivileged youth are members of the group without transportation. Here, then, appears a definite aspect for consideration in program planning.

TABLE XXI

Older Youth Interviewees Reporting Transportation Available for Use in
Attending Educational and Recreational Programs,
Six Survey Parishes, Louisiana, 1952

Transportation Available	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Yes	228	90.5	274	88.4	502	89.3
No	24	9.5	32	10.3	56	10.0
No Response	0	....	4	1.3	4	0.7
Total	252	100.0	310	100.0	562	100.0

Distance Willing to Travel

Regardless of the availability of transportation there is usually a limit to the distance one is willing to go to attend a meeting. After a marginal point in mileage is reached the individual is likely to feel the benefits to be derived are outweighed by the inconvenience brought about. The responses to the query in this regard are indicative of the safe limits within which to recruit youths for social participation of one kind or another.

Well over one-half (52.3 per cent) of the interviewees felt that they would not be imposed upon by being asked to travel up to 20 miles to attend either an educational or recreational function. Indicating the consensus of agreement on this point, approximately the same proportion of the girls (50.2 per cent) as the boys (54.8 per cent) drew the line at 20 miles. Although some of the respondents were willing to go farther (21.2 per cent anywhere in the parish and 9.8 per cent anywhere up to 36 miles), it seems highly unlikely that anything but the most attractive program will succeed at greater distances than 20 miles from any considerable segment of the potential audience. The above data appear in Table XXII.

SELECTED ASPECTS OF THE MENTAL COMPLEX OF OLDER RURAL YOUTH

As mentioned in the introductory section of this report, social behavior is, to a large extent, determined by the mental complex of the members of the particular population group. In other words, people are conditioned to behave on the basis of their social experience. Through

TABLE XXII

Distances Older Youth Interviewees are Willing to Travel to Attend
Educational and Recreational Programs, Six Survey Parishes, Louisiana, 1952

Distance	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Less than 5 Miles	4	1.6	19	6.2	23	4.1
5 - 20 Miles	138	54.8	156	50.2	294	52.3
21 - 36 Miles	29	11.5	26	8.4	55	9.8
Over 36 Miles	29	8.3	27	8.7	48	8.6
Anywhere in Parish	38	15.1	33	10.7	71	12.6
No Response	22	8.7	49	15.8	71	12.6
Total	252	100.0	310	100.0	562	100.0

their everyday conditioning they come to attach importance to certain values, goals, and ideas. These orientations, obviously, vary from one society to another and from one group to another within a given society. It follows that older rural youth, as a special population segment, not only have special problems but face these problems in a special way dependent upon their systems of values and attitudes. The person who is to understand them, then, is in need of as much information relative to their mentality as he can get. With the above in mind all interviewees were asked several leading questions bearing on their particular social experiences. The analysis of the responses to these questions appears below.

Youth Having Plans for the Future

One indication of the mental state of youth may be derived from a knowledge of their plans for the future. The proportion of persons having a definite course of action in mind is one indication of the extent to which the total society has been able to provide opportunities for its youth. On the other hand those persons not having plans for the future, in all likelihood, represent persons with serious problems in terms of personal adjustment. They are the persons who, for some reason, are insecure about the present state of their lives and have little or no orientation to face the life situation which is upon them.

The concern which Extension personnel have shown over this segment of our rural population is justified in the responses of the youths interviewed. (See Table XXIII.) As many as 44.5 per cent of these respondents had no definite plans for the future. Although it is conceivable that some few of this number had not gotten around to giving serious thought to this problem, the great majority must be looked upon as persons stranded in the midst of a moving stream of their fellows. It is understandable that a slightly higher proportion of girls were not sure of their future. The latter necessarily do not plan as readily for the future, as they must await the somewhat undeterminable opportunity for marriage. However, the differential between boys and girls is not



Older youth are at the "crossroads of life." They seek information on many topics . . .



. . . and need proper guidance and counseling.

great, 42.5 per cent of the former as compared with 46.1 per cent of the latter saying they had nothing in mind for the future.

TABLE XXIII
Older Youth Interviewees Having Definite Plans for the Future,
Six Survey Parishes, Louisiana, 1952

Definite Plans for the Future	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Yes	139	55.1	161	52.0	300	53.4
No	107	42.5	143	46.1	250	44.5
No Response	6	2.4	6	1.9	12	2.1
Total	252	100.0	310	100.0	562	100.0

To the person interested in helping the older rural youth group the above figures mean one thing above all. These young people need to be given a sense of direction. One hesitates to contemplate the end result should the society at large forego its responsibility in this connection.

Youth Discontented in Their Present Occupations

One index of how satisfying their present life has been to older rural youth is whether or not they have given serious thought to leaving their occupation or location. It is thus that it was deemed important to determine to what extent young men and women were satisfied with their present day life. Each person interviewed was asked, "Have you thought of leaving your present occupation or location?" The answers given were tabulated and appear in Table XXIV.

TABLE XXIV
Older Youth Interviewees' Desires with Respect to Leaving Their Present Occupation or
Location, Six Survey Parishes, Louisiana, 1952

Serious Thought to Leaving	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Yes	62	24.6	92	29.7	154	27.4
No	183	72.6	211	68.1	394	70.1
No Response	7	2.8	7	2.2	14	2.5
Total	252	100.0	310	100.0	562	100.0

As may be seen, well over one-fourth (27.4 per cent) of the interviewees had given serious thought to leaving their present occupation or location. Interestingly, more girls (29.7 per cent) than boys (24.6 per cent) expressed dissatisfaction with their situation. This pattern of response is in line with the short-distance migration patterns (selective for women), however, and validates the findings of the study to this extent. It is perhaps just as significant that 70.1 per cent of the interviewees said they had not thought about leaving their present situations. Both findings are pertinent in that they shed light on the thinking and problems of older rural youth.

Opinions About Farming as a Way of Life

Perhaps more can be learned about the future of agriculture by determining how satisfactory a way of life it is thought to be than by any other means. It stands to reason that if rural youth are sold on farm life, not only as a way of making a living but as a way of living as well, then the future of agriculture is bright. If rural youth are not happy with rural living as compared to urban living, then the future of farm life is indeed bleak. All interviewees were given an opportunity to express their opinion on this matter. Their responses are shown in Table XXV.

Apparently young people in the rural areas of the state think of farm life as the good life, whether or not they intend to remain in agriculture as a vocational pursuit. Three-fifths of the interviewees went all out and stated unequivocally that farming was a superior type of living. Somewhat surprising is the fact that relatively more girls (62.6 per cent as compared with 57.5 of the boys) expressed this opinion. Perhaps recent trends in farm home conveniences have tended to make this life more attractive to girls.

TABLE XXV

Older Youth Interviewees' Opinions on Farming as a Way of Life,
Six Survey Parishes, Louisiana, 1952

Opinion	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Superior	145	57.5	192	62.0	337	60.0
Very Satisfactory	46	18.3	57	18.4	103	18.3
Satisfactory	20	8.0	18	5.8	38	6.8
Unsatisfactory	16	6.3	23	7.4	39	6.9
Very Unsatisfactory	3	1.2	1	0.3	4	.7
Undecided or No Opinion	22	8.7	19	6.1	41	7.3
Total	252	100.0	310	100.0	562	100.0

Another 18.3 per cent of the youth expressed the opinion that farm life was very satisfactory and 6.8 per cent said it was satisfactory but nothing else. To 6.9 per cent of the interviewees, farming was unsatisfactory as a way of life and four persons (0.7 per cent) felt it was highly uninviting. One is safe in assuming that those persons with opinions classifiable under the last three categories are not sold on farm life. This is a rather high proportion (21.7 per cent). On the other hand those persons who felt this kind of life was superior or very satisfactory (78.3 per cent) can be classified as seeing something in rural living which is attractive. In final analysis, the latter group is large enough to assure a steady support of farming and farm life.

Individuals of Outstanding Influence in Older Youths' Lives

It has been said that there is someone of outstanding influence in almost everyone's life. These persons of influence are usually cast in the role of confidant and advisor. They are the ones turned to in time of

crisis or major decision. Thinking in terms of youth at the crossroads of life it is of major importance that their counselors be known, both for the kind of advice they might give and for the purposes of reaching them with materials of use in guidance.

Of the data appearing in Table XXVI the most significant fact seems to be the large percentage (43.3 per cent) of youth who said no person was of outstanding influence in their lives. This may account for the fact that so many of them had no definite plans for the future. At any rate it is a positive indication that they need to find someone to whom they can go for guidance and counseling.

As one would expect, the largest number of youth singling out particular persons as of major influence in their lives (31.7 per cent) named one or the other of their parents. It is not surprising that girls were more likely to turn in this direction for a counselor. Of significance is the fact that the second largest group of advisors named included professional persons such as teachers and county agents. Over one out of every ten interviewees (11.7 per cent) said a professional person of this type had been of outstanding influence in their lives. Here is a commentary on both the present and potential role which such persons might play.

Other classes of persons named as ones turned to for advice are as follows: spouse (3.9 per cent), close friend (3.7 per cent), brother or sister (2.5 per cent), other blood relatives (1.4 per cent), in-laws (1.1 per cent), and grand-parents (0.7 per cent).

TABLE XXVI

Particular Individuals Reported by Older Youth Interviewees as Being of Outstanding Influence in Their Lives, Six Survey Parishes, Louisiana, 1952

Relation of Individual to Interviewee	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Parent	73	28.9	105	33.9	178	31.7
Brother or Sister	8	3.2	6	1.9	14	2.5
Grandparent	3	1.2	1	0.3	4	0.7
Other Blood Relatives	5	2.0	3	1.0	8	1.4
Spouse	2	0.8	20	6.4	22	3.9
In-Laws	—	—	6	1.9	6	1.1
Close Friend	9	3.6	12	3.9	21	3.7
Teacher, County Agent, etc.	26	10.3	40	12.9	66	11.7
No Person of Outstanding Influence	126	50.0	117	37.8	243	43.3
Total	252	100.0	310	100.0	562	100.0

Type of Counseling Preferred

In order to complete the picture as nearly as possible for people interested in guiding older rural youth, each respondent was asked to list the type of counseling he or she preferred. This information gives further

insight into the mental conditioning of the individual and is useful in planning the type of approach to be used.

As may be seen in Table XXVII almost two-thirds (63.6 per cent) of the sample population indicated they preferred counseling on a group basis. While this response might be surprising to some leaders, it certainly makes the task involved much simpler. In this connection approximately the same proportion of boys as girls said such was their preference. The counselor will have more difficulty reaching the 28.5 per cent of the youth who did not feel they would receive the kind of attention they needed in a group situation. This rather large segment of the population, no doubt, is composed of the persons who either because of the intimacy of their problems or their personality make-up need special consideration. The size of this group, composed of approximately the same proportion of boys and girls, and their expressed preferences make it advisable for counselors to make special arrangements for them. Otherwise they will suffer from a lack of the help they need.

TABLE XXVII

Older Youth Interviewees' Preferences with Respect to Counseling on an Individual or Group Basis, Six Survey Parishes, Louisiana, 1952

Type of Counseling Preferred	Boys		Girls		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Individual Basis	71	28.2	89	28.7	160	28.5
Group Basis	159	63.1	199	64.2	358	63.6
No Preference	8	3.2	4	1.3	12	2.1
Undecided	0	--	2	0.7	2	0.4
Not Interested in Either Type	1	0.4	1	0.3	2	0.4
No Response	13	5.1	15	4.8	28	5.0
Total	252	100.0	310	100.0	562	100.0

Very few persons (2.1 per cent) had no preference as to the type counseling they would like to receive. It is an indication of the seriousness with which youth regard this problem that only 0.4 per cent of them said they were not interested in any kind of help.

SUMMARY AND CONCLUSIONS

The salient findings of the preceding analyses may be summarized as follows:

1. The population data collected makes clear some important characteristics of the older rural youth population. First, there are large numbers of older youth in the rural regions of the state but more of them reside in rural-nonfarm areas than in rural-farm areas. In this connection the rural-farm older youth population is decreasing at a tremendous rate while the rural-nonfarm population is just about holding its own. Despite the fact that there is a slight excess of males among the older rural youth population, all indications are that the situation will be reversed in the near future. It may be noted that the rural-farm segment of this population at present contains an excess of males while the rural-nonfarm segment has a shortage of males. Third, it is of significance that the youth residing in rural-farm areas are, on the average, very much younger than those living in rural-nonfarm areas. Fourth, the older rural youth population contains an important segment of non-whites in its make-up.

2. Older rural youth of the state, as shown in their interest in formal programs of education and recreation, feel a keen need for a more complete social life. Their past experiences in formal organizations are such as to lead one to expect that they would not be too difficult to work with in this manner. In this connection, the type of recreational outlets they have had leaves something to be desired in terms of well organized activities suitable for joint participation of boys and girls.

3. Older rural youth preferences with respect to educational programs indicate a strong desire for more information on topics dealing with the home, family, farm, and business. In this regard, they feel educational meetings should include community groups and be held on a Wednesday, Friday, or Saturday evening. The great majority of older rural youth prefer the demonstration technique of presenting educational material. Many of this group use the radio and newspaper and other periodicals as sources of information.

4. According to their responses, older rural youth are partial to sports of one kind or another, movies, and dances as recreational outlets. They are keenly interested in planned recreational activity, however. Their remarks indicate that a community-wide social event planned for a week-end day and set for an evening hour would be a great success.

5. In general, older rural youth prefer joint educational and recreational programs. In this respect, most of them have transportation facilities and would be willing to travel as far as 20 miles to attend such programs.

6. The responses of older rural youth give many indications that they are at a time when guidance and counseling is sorely needed. In this

connection a significant proportion of them have no definite plans for the future. Also, many of them have given serious thought to leaving their present occupation or location. Furthermore, a large number have not found a suitable person to whom they can go for personal guidance. With respect to the latter point, the majority would prefer counseling on a group basis but many persons would need individual attention.

In conclusion, much of the above information should be of interest to the local community leaders and persons professionally interested in bettering rural life. In fact, the needs and problems of older rural youth, as implied in the findings of this study, represent a definite challenge to all who are sincerely concerned with this segment of our population.



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WHITE CLOVER

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LA. BULLETIN NO. 479

Louisiana State University
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LOUISIANA SI WHITE CLOVER

C. R. OWEN

White clover has contributed much to the development of grassland agriculture in Louisiana as well as in the remainder of the southeastern region. It was probably among the first legumes used for grazing in the state. Although little is known of its earliest use, reference is made to white clover during the nineteenth century which would indicate that its introduction into this area was much earlier.¹ In an early bulletin by the Louisiana Agricultural Experiment Station is this brief reference: "*Trifolium repens* (white clover) grows wild and luxuriantly all over the south and middle of Louisiana and affords our earliest spring pastures."² Prior to comparatively recent times this crop has not been seeded by farmers but has become spread over much of the region of south and central Louisiana by livestock, flood waters, and other natural means.

White clover is considered native to all countries of western Europe. From there it has spread to many parts of the world. In North America it is found growing from Newfoundland to British Columbia and from Florida to California. It is found in every continent and most of the major islands, including Greenland.³

An adaptation range for a plant species such as the one described for white clover is unusual, especially when in so much of the area from the Arctic Circle to the subtropical region it has apparently appeared without having been intentionally introduced by man and returns year after year either as a perennial, or reseeding naturally and coming back each season in natural stands. In fact, white clover is said to have accompanied the spread of western civilization in America so closely that it was called "white man's foot grass" by the Indians. It would be expected that many different forms would have arisen, as has been the case with corn. Yet, up to the present time only three types are recognized: (1) the large type, represented by Ladino; (2) the intermediate type, in which Louisiana white, New Zealand white, and others are so classed; and (3) the low growing type of which the New York wild white clover is an example. These types are products of natural selection within the regions of their respective origin. The differences among them are in size and in general performance. It is generally regarded that considerable variation is present in each type, which is borne out by the extent to

¹Honorable J. B. Robertson, *Memorial and Explorations in Relation to the Agricultural, Mineral and Manufacturing Resources of the State*, (January 1867).

²*Forage Crops, Grasses, Clovers and Small Grain*, Bulletin 19, Second Series, (Louisiana Agricultural Experiment Station, 1892), p. 543.

³Adelia G. Erath, *White Clover (Trifolium repens L): A Monograph*, (London: Duckworth and Co., 1924), pp. 1-3.

which white clover has become spread in the various climates of the world. Undoubtedly, many diverse sorts will be developed from this species as the needs arise.

A different type of white clover than those referred to above is needed in the southern region. Louisiana white clover, as is generally known, behaves normally as a winter annual. It blossoms and produces seed in late April through May and dies soon after, usually in June. It emerges from seed in late fall and is usually present in pastures during early spring. Under normal conditions, only about three or four months of grazing can be expected from it each year. The value of white clover would be very much increased if its grazing season were extended. A breeding program was initiated in 1945; the principal objective was to establish within Louisiana white clover more heat and drought tolerance.

This work was started by making a survey of the clover fields within the state in August, 1945. Seed heads were collected from plants which had survived the summer. The seed were removed from these heads and were used as the beginning of the white clover breeding program. Seed from the larger, better filled heads were selected for use in planting progeny rows. Seeds from heads less well filled were used in making additional random space-plantings in an adjoining area. Seed were germinated in the greenhouse during the winter and the plants transferred to the field in April, 1946.

Observations were made at intervals during the spring and summer, survival counts being made in early September. Plants with as many as a few green leaves were counted as surviving. (The percentage of plants surviving the summer is given in Table 1.) Counts were made only on those plots which were planted as progeny. The average survival is high for Louisiana white clover, indicating that selection for heat and drought tolerance characteristics in white clover was effective.

TABLE 1. Summer Survival of Space-Planted White Clover Progeny from Seed Heads Collected from White Clover Fields, August 1945

Per Cent	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	Mean	C. V.
Number	3	2	8	9	8	12	9	5	6	10	6	10	13	10	7	6	7	1	56.6 $\pm$ 1.0	38.5 $\pm$ 2.75

Selection of Clones

After the weather conditions had become favorable for revival growth of white clover, the plants were reclassified on the basis of the quantity of growth as indicated by the area the plant had covered during the season and the ability of the clone to maintain the forage over the area. Finally, from approximately 4,000 seedlings transplanted into the nursery in April, 35 were selected the following October. The plants selected to be used as clones for further evaluation studies had spread over an area of five square feet or more and had maintained coverage over this area. It was necessary to reduce the number to 25 due to insuf-

ficient testing area. Five of the extra clones were transplanted into the guard plots at the side of the test plots.

Evaluation of Clones

The clone evaluation experiment was conducted during the seasons of 1947 and 1948. The clones were transplanted in the center of plots 14 feet square. The plots were arranged on a square block with five plots on a side. This experimental design, known as the lattice square, was completed with three replications. Within these plots each clone was observed for vigor, as indicated by the rate it had spread; each plot was observed for heat and drought tolerance indicated by the amount of white clover left at the end of the summer. Forage harvests were made each year at such time as the seed was matured. Seed was threshed from the forage after it had been dried and weighed, with yields of both seed and forage recorded. (The results of these experiments are summarized in Table 2.) From this experiment Clones Number 6, 15, 21, and 23, together with Clone 26 not listed among these, were superior and were used in the clone combination of Louisiana 51.

Further testing techniques were used in evaluating the clones. These techniques are considered as routine for such crops and are described

TABLE 2. Comparative Growth and Development of Selected Clones, 1946, 1947, 1948

Clones	Area Spread, Sq. Ft.			Per Cent Cover		Forage Yield		Seed Yield	
	1st Yr. 1946	1947	1948	1947	1948	1947	1948	1947	1948
1	7.56	80.00	94.1	53	8.6	1053	1562	66.0	95.2
2	5.52	96.76	96.9	62	11.8	2239	2482	177.0	155.0
3	5.98	56.00	74.5	10	8.1	1176	1737	52.0	75.0
4	10.56	53.30	79.9	9	4.6	882	1913	52.7	98.0
5	8.12	89.30	132.5	86	28.1	1783	3679	99.3	161.0
6	9.00	97.00	139.3	91	49.1	2314	3971	170.0	141.0
7	11.30	83.30	92.0	65	31.1	797	2146	41.0	61.0
8	6.75	90.60	88.7	57	20.2	1527	1781	93.0	89.0
9	8.96	82.00	114.1	67	6.0	1394	2920	104.0	158.0
10	7.02	93.00	80.8	63	10.0	1385	2394	68.0	107.0
11	6.25	92.30	101.2	42	34.4	1442	3095	60.0	83.0
12	7.00	91.00	107.6	16	32.5	1365	1503	111.0	133.0
13	5.98	87.30	89.9	27	20.5	1603	2380	89.0	99.0
14	12.00	70.00	91.0	45	16.9	1375	2102	51.0	76.0
15	14.82	88.30	146.9	86	31.8	1878	3635	63.0	171.0
16	10.15	76.00	98.5	42	16.5	1138	2161	46.0	77.0
17	6.67	86.00	102.3	42	11.6	1764	2905	64.0	111.0
18	5.46	82.00	80.7	62	28.5	939	1387	30.0	67.0
19	5.98	40.00	66.8	12	17.9	322	1840	58.0	84.0
20	8.84	80.00	98.8	38	3.5	1422	2686	107.0	163.0
21	7.83	96.00	120.9	84	41.0	2694	3431	90.0	107.0
22	9.18	83.70	78.1	48	34.2	1850	2029	81.0	75.0
23	11.10	94.00	126.9	87	30.0	1840	3387	90.0	152.0
24	10.89	75.00	92.0	12	10.8	636	1986	58.0	96.0
25	9.90	53.00	80.5	24	13.5	597	1708	48.0	59.0
LSD									
5%	---	12.90	33.0	25.6	26.3	1144	349	47.0	43.0

fully by Johnson.⁴ White clover is cross pollinated; thus, each seed that is set must have received pollen from a blossom of another plant. The clones proved to be perennial; that is, they lived continuously throughout the three years. It appeared that with ordinary care they would continue to live indefinitely. They had also shown, later, to possess good combining ability. (See Table 3.) Consequently it was evident that the most effective means of utilizing them was by recombining the five into a synthetic variety.

TABLE 3. Forage Yield Distribution for Polycrosses, Synthetic Varieties, and White Clover Varieties, 1952, Second Year After Seeding

Entry	Yield Pounds per Acre Dry Matter				Total
	Jan. 16	March 6	May 8	June 9	
S1, First Year	1111	2360	3763	944	8178
S1, Second Year	1029	2236	4099	1265	8629
6 Polycross	1204	2533	4205	877	8819
15 Polycross	1055	2600	4495	1055	9205
21 Polycross	1319	2569	4193	899	8980
23 Polycross	1212	2162	4624	1399	9397
26 Polycross	1325	2504	4219	1399	9447
Louisiana White	275	2020	3752	555	6602
Ladino	604	1725	3555	2520	8404
LSD 5% Point	118	302	651	426	1053

Forming the Synthetic Variety

The synthetic variety was formed by transplanting the clonal material into an isolated intercrossing block. The first intercrossing block was planted in the fall of 1948. The clonal lines were transplanted into rows, each clone to a row in sets of five. There were several sets of rows in the block, so that the clones could be arranged in such a manner as to insure maximum intercrossing between all clones. In order to insure more complete intercrossing among the clones, hives of honey bees were located at one end of the field.

Testing the Variety

Seed was harvested from the clone rows the following spring. All clones were harvested and threshed in mass and, through the process of threshing and cleaning, the seed were thoroughly mixed. This seed was used for planting the forage yield evaluation experiments as well as for planting seed increase fields. Forage yield experiments were planted to compare this combination of clonal lines with Louisiana white clover, Ladino, and other strains from different sources. (The results of the forage yield evaluation are given in Table 4.) Yields of only Louisiana white and Ladino are given since most of the other entries did not differ significantly from these. It was evident from the comparative forage

⁴I. J. Johnson, "Forage Crop Breeding," *Forages, the Science of Grassland Farming*, Hughes, Heath and Metcalfe, (Ames: Iowa State College Press, 1952), p. 124.

TABLE 4. Forage Production with Varieties and Strains of White Clover: Total Annual Yield on Olivier Silt Loam

Entry	Forage Yields				%
	Dry Matter per Acre				
	1950	1951	1952	Avg.	
Louisiana White Clover S1	8333	3427	7809	6523	127
Ladino, Certified	6749	3643	7577	5990	117
Louisiana White	6696	3043	5632	5124	-----
Least Significant Difference (5%)	207	294	249		

yields that the synthetic combination was definitely superior to the regional strain Louisiana white clover. Plans were made to increase the seed supplies for release to the farmers of Louisiana. The new combination was first called Louisiana Synthetic 1 and it later became known as Louisiana S1 white clover. Forage yield trials were planted at six locations in Louisiana outside the Baton Rouge area. The results are not included, but the synthetic variety was reported as superior to other varieties and strains of white clover tested at each station.

The seasonal growth distribution of the varieties and strains of Louisiana S1, Louisiana white, and Ladino is given in Figures 1 and 2. Louisiana S1 produces more forage from late fall and early winter until

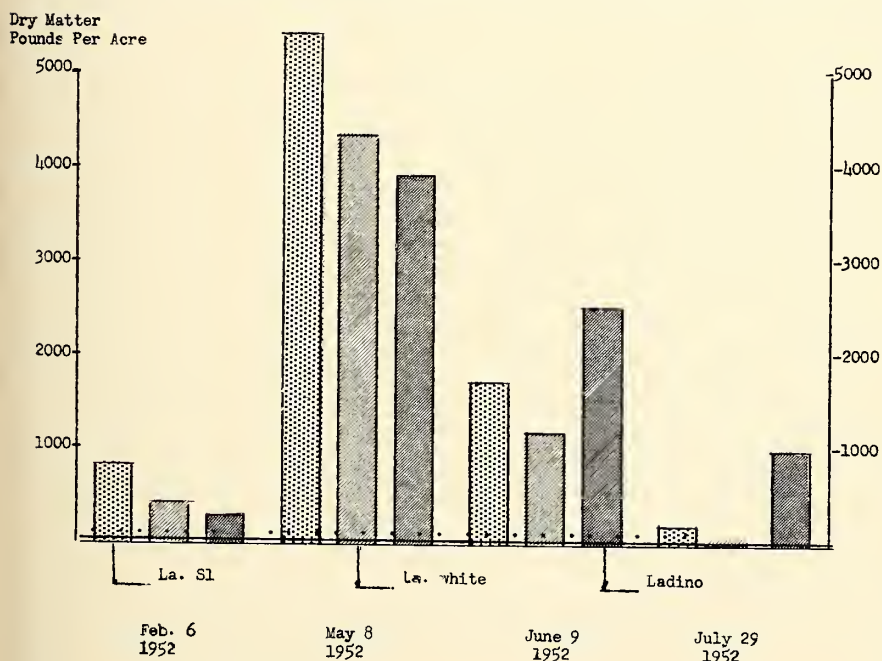


FIGURE 1. Forage production with varieties and strains of white clover: first season growth after seeding.

Dry Matter
Pounds Per Acre

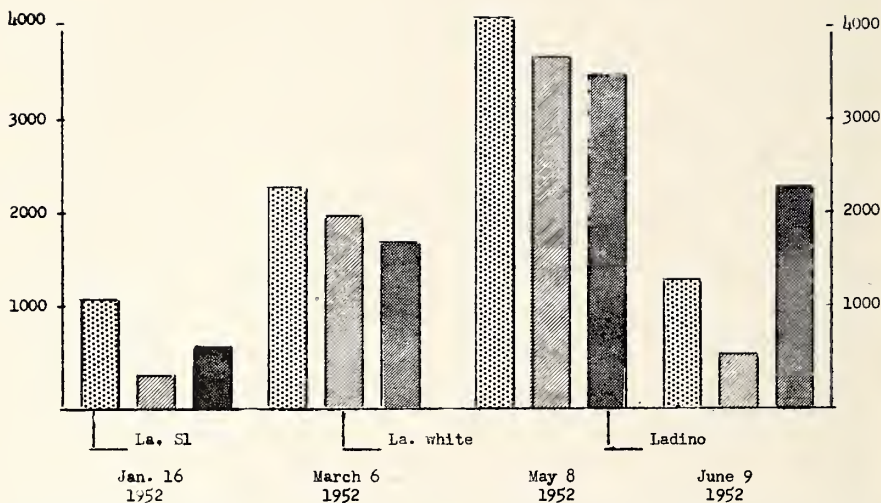


FIGURE 2. Forage production with varieties and strains of white clover: second season growth.

May than either Ladino or Louisiana white from tests of both the first and second year after seeding. Ladino is more productive than Louisiana S1 or Louisiana white after May through June and July. It thins out during late summer and, since no seed are produced, would require re-seeding each fall. Figure 4 is a photograph of Ladino growing under artificial light in the greenhouse. Blossoms are formed readily at day lengths of 14 to 16 hours per day. Louisiana S1 blossoms at about the same rate as the common regional Louisiana white variety in a similar environment.

The Program of Seed Production with Louisiana S1 White Clover

Seed production with Louisiana S1 white clover involves the routine of maintaining the parent clones by the Experiment Station, establishing the intercrossing block at regular intervals of from two to three years, increasing the seed from this block to produce foundation seed, and producing an adequate supply of foundation seed. The foundation seed is planted by the seed grower who in turn produces seed for certification.

The parent breeding stock represented by the five clone lines is kept on the Experiment Station farm. Each clone is grown in a plot about 1/500 acre in size. They are transferred every other year to fresh, clover-free soil where the clones grow and produce the cuttings necessary for planting the intercrossing block. Transferring the clones to fresh beds

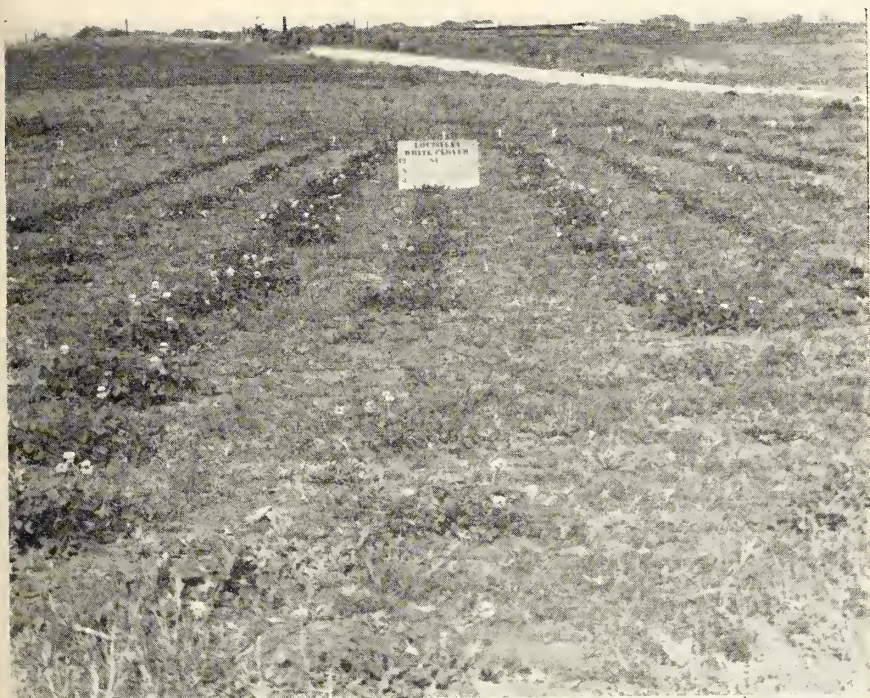


FIGURE 3. Intercrossing blocks are transplanted from clone cuttings. Each clone is planted to a row. The five clones occur in sets of five rows, repeated several times over the field. Below: Clone piece developed from small cutting transplanted to field in November, photographed following March.

every other year is a necessary precaution against contamination from seedlings arising from seed produced by the clone. The clones which go into the synthetic variety must be kept pure for as long as the variety is in the seed production program.

At this stage in the program it is thought highly desirable, if not absolutely necessary, to transplant clone cuttings into new intercrossing blocks every second or third year, if for no other reason than to maintain a supply of breeders' seed. The hazards to clone material in the field are considerable and whenever the clone is thinned by weed competition or machinery operation, seedlings arise in the places where thinned. Intercrossing blocks have been from three-fourths to one and one-half acres in size. Sufficient breeders' seed has been produced from these blocks to plant 20 to 40 acres for the production of foundation seed.

From the intercrossing block through the routine of increasing the seed for release to farmers for growing certified seed, two or more generations have elapsed. Under normal conditions no additional changes are expected to occur in the yielding ability of the variety. A synthetic variety which is the result of the recombination of selected non-inbred plants or clones is expected to maintain its vigor indefinitely under normal conditions.

Certified Seed Production

In the foregoing sections a brief description has been given of the production of breeders' seed and foundation seed. The third and last step between the developmental techniques used in the production and release of an improved strain or variety of field crops is the production of certified seed. Certified seed, according to Hollowell, is seed of known genetic identity and of high germination, purity, and freedom from harmful weed seed.⁵ Standards for the production of certified seed for Louisiana S1 white clover, as well as for other crop seeds, may be obtained by writing the certifying agency of the state. For Louisiana the certifying agency is the State Department of Agriculture. The standards are set up to safeguard the quality the buyer of certified seed has a right to expect. The quality found in certified seed is the result of the extra precautions taken prior to the time the seed is bagged. This supply must be kept pure or much of the improvement bred into the variety will be lost.

Aside from the care necessary to fulfill the requirements set up by the standards for certification, the production of certified seed of Louisiana S1 differs very little from that of ordinary white clover. The average acre yield of white clover seed for Louisiana for the period 1939-51 is 47.4 pounds per acre.⁶ On the other hand, acre yields of 200 pounds or more are not unusual in the state. Preliminary to any other plans for seed production, an effort should be made to increase the acre yield. While yields of 50 to 75 pounds per acre may be profitable in some instances,

⁵E. A. Hollowell, "Legume and Grass Seed Production," *op. cit.*, p. 110.

⁶*Acre Yields and Production of Field Seed Crops, 1939-51*, (U.S.D.A. Bureau of Agricultural Economics, June 1952), pp. 14-15.



FIGURE 4. Ladino blooms freely under long light periods. With 14 to 16 hours of continuous light in the greenhouse, this bed of Ladino blooms nearly the entire year if protected from intense heat during the summer.

an acre production two to several times that amount would be much better. From the standpoint of improving the production per acre there are no substitutes for the practices of: (1) using adequate quantities of the right kinds of fertilizers, (2) preparing the land well for furnishing the best type of seedbed, and (3) keeping the weeds under control after the clover begins growing. Other factors for consideration after these have been provided for are: (1) rate and time of seeding, (2) seed inoculation, particularly on land suitable for producing certified seed, (3) supply of pollinating insects, and (4) seed harvesting and cleaning machinery. Success in seed production with white clover as well as with any other crop will depend to a large extent upon attention given to it as a crop and not just as a sideline to pasture or other uses to which the clover forage may be channeled. Certainly this clover is meant to be used principally as a pasture crop, but, as with any other crop, with new strains a supply of seed must be made available before it can be used for the purpose intended.

There is practically no information available regarding the plant nutrient requirements for seed production with most small-seeded forage crops. It may be regarded as safe to follow the recommendations for

clover pasture except that heavier rates should be more profitable for seed than for pasture.

Land preparation is more important with a crop which is to occupy the land for two or more years than for those which occupy the land only one season. Any inadequacies in the seedbed preparation may be reflected in the performance of the crop during the entire period the crop occupies the land. Clover seed planted on a loose, cloddy seedbed is seriously handicapped regardless of the degree of fulfillment of the requirements of other practices.

Weed control is as essential with a crop like white clover seed as with any other crop. Weeds are generally controlled by mowing. If mowing is used for control, it should be started as early after the crop begins growing as is needed. It may be necessary to clip the clover back in the early spring to prevent excessively large growth. Chemical weed control may be used under certain circumstances.⁷ White clover is not affected by 2-4-D applied in the right concentrations according to the report from the Mississippi Experiment Station.

Methods and Rates of Seeding

The rate of seeding Louisiana Sl is about five pounds per acre. This is considered to be in excess of the absolute need if weather conditions are favorable. However, for insurance in obtaining a stand, as well as to have the ground covered with clover plants as early as possible, this excess is recommended. The time for seeding is middle to late October, provided the soil moisture condition is favorable. It does not pay to seed white clover in dry soil, especially if the seed are to be inoculated. The earlier the seed is sown after the soil condition becomes favorable, the better.

The seed should be planted on a smooth, firm seedbed; a light mulch is preferred to receive the seed. The land should be firmed with a standard weight cultipacker as soon as possible after sowing. The cultipacker following the light mulch will cover the seed adequately on most soils.

Weeds

Certain weeds found in white clover fields may not be controlled by normal mowing or other known means. Dodder is the principal example in this class. Dodder seed is a most objectionable noxious weed seed and every care should be exercised to keep clover seed from getting contaminated with it. It is more severe during years that white clover is late in reaching maturity. When a white clover field becomes severely infested, it is usually best to plow the crop under and follow it with a cultivated row crop. When light infestation is present, it may be destroyed by burning. The field should be inspected for dodder early and it may be destroyed by merely removing it from the field by hand. Curled

⁷"Chemical Weed Control Guides for 1953," *Mississippi Farm Research*, (February 1953), p. 3.

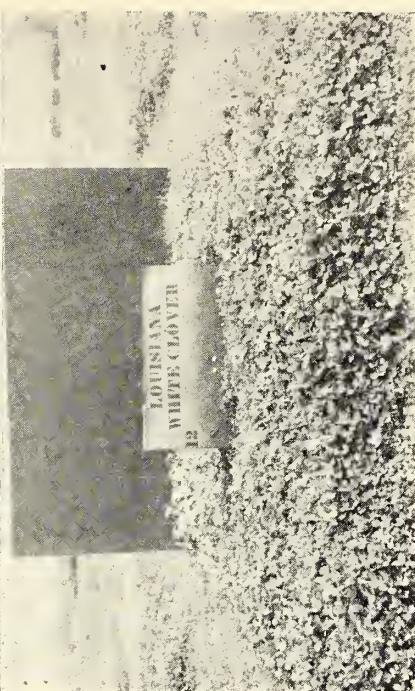
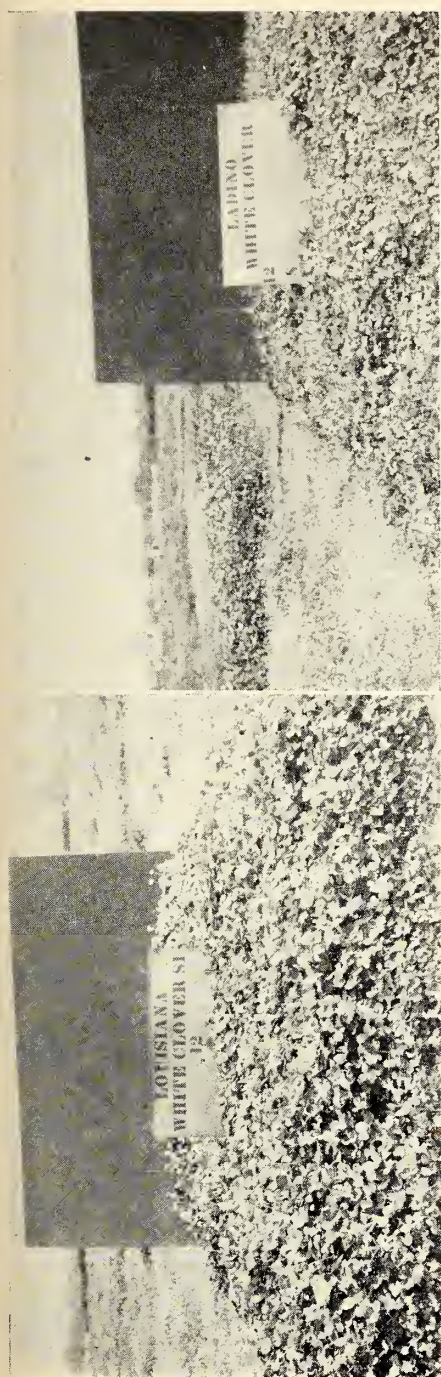


FIGURE 5
Earlier growth may be expected from Louisiana S1 than
with other types. (Photographed March 2, 1953.)

dock (*Rumex spp.*) is difficult to control in seed fields if it gets a start. It cannot be controlled easily by either mowing or burning. Some farmers have reported success with chemical control of this weed.

Pollination

As mentioned before, white clover is cross pollinated and is dependent upon pollinating insects for seed setting. Wild stands of white clover may be adequately pollinated by wild bees. With the increase in the acreage of white clover and other such crops, the supply of natural pollinating insects is sure to become inadequate. Farmers considering seed production with white clover should investigate the possibilities of acquiring as many bees as is practical to do the pollinating. One hive per acre is advocated by some authorities.

Seed Harvesting

White clover seed may be matured sufficiently for harvesting four to five weeks after the peak blooming season has passed. The peak of blooming occurs just after the decline in growth begins. The seed are mature in a head usually after the supporting stems lose the green color. Harvesting should be done when there are more mature heads than immature heads. Actually the percentage of mature heads should be about 75 or more. Weather reports should form the basis for determining the day for mowing the clover after this stage of maturity is reached.

Harvesting is done by cutting clover with a mower. It is allowed to cure in the swath, after which it is either threshed from the swath by the use of a combine with a windrow pickup attachment or windrowed and threshed from the windrow. If the growth is heavy and the weather is favorable for drying, it may be picked up from the swath. It should be windrowed where the forage is not heavy enough to be picked up from the swath or when weather conditions make curing slow in the heavier forage growth. In either event the clover should not be disturbed unnecessarily after the seed heads are dry.

Most combines or threshing machines now available were not designed especially for threshing small seed, but were designed for threshing cereal grain and larger seed. Very careful adjustment may be necessary for best results from these machines with clover seed. Every precaution should be taken to make such necessary adjustments as soon as is practical after the threshing operation begins.

Cleaning the Seed

Two types of seed cleaning machines are usually required to clean white clover seed after it has been threshed with the standard combines or thresher. It is first run over screens which remove the foreign material that differs in size from the seed. This machine is also equipped with a blower which fans out some of the light material similar in size to white clover seed. For complete cleaning, a second machine known as the gravity seed separator is almost essential. These machines are costly

and require some skill to be operated successfully. It will probably be more practical for the average seed grower to depend on the commercial seed cleaners for cleaning his seed. Growers of certified seed should contact the certifying agency for a list of seed cleaning plants that meet the requirements for cleaning such seed.

Louisiana S1 White Clover for Pasture

The characteristics of S1 white clover were bred into it for the sole purpose of making the variety more valuable for use in pastures in Louisiana. The fact that it revives earlier in the fall and lasts later into the summer should make this variety well worth its adoption for use in pastures. At this time no comparative data are available in terms of animal gains to substantiate the claim of the superiority of Louisiana white clover. It was only during the past two seasons that seed supplies have been available for planting in sizeable acreages. During 1952 it was used for grazing and the reports were favorable. Forage yield tests from small plots have been planted on the branch Experiment Station farms in other areas of the state during the past three years. The results from these have been in favor of Louisiana S1 white clover. It is expected that this variety of clover will prove beneficial in improving fields of Louisiana white clover now found growing in pastures over the state. It should be better in new pastures where white clover has not grown before.

Summary

Louisiana S1 white clover is a synthetic variety developed by intercrossing five clonal lines selected from Louisiana stocks of white clover.

The clones were selected on the basis of their ability to yield and to tolerate hot, dry weather. These characteristics have been transmitted to the synthetic variety and have resulted in substantial improvement as compared to the common Louisiana white clover. Seed production is equal or superior to that of the common white clover in Louisiana.

The improvements bred into Louisiana S1 white clover enable it to live through the summer and fall of most years and to revive from the stolons in the fall. It, thereby, is able to reach grazeable size from six weeks to two months earlier than ordinary white clover. It also may be grazed several weeks longer in the late spring and early fall.

Cultural methods for seed production with this clover as well as other white clovers are discussed.

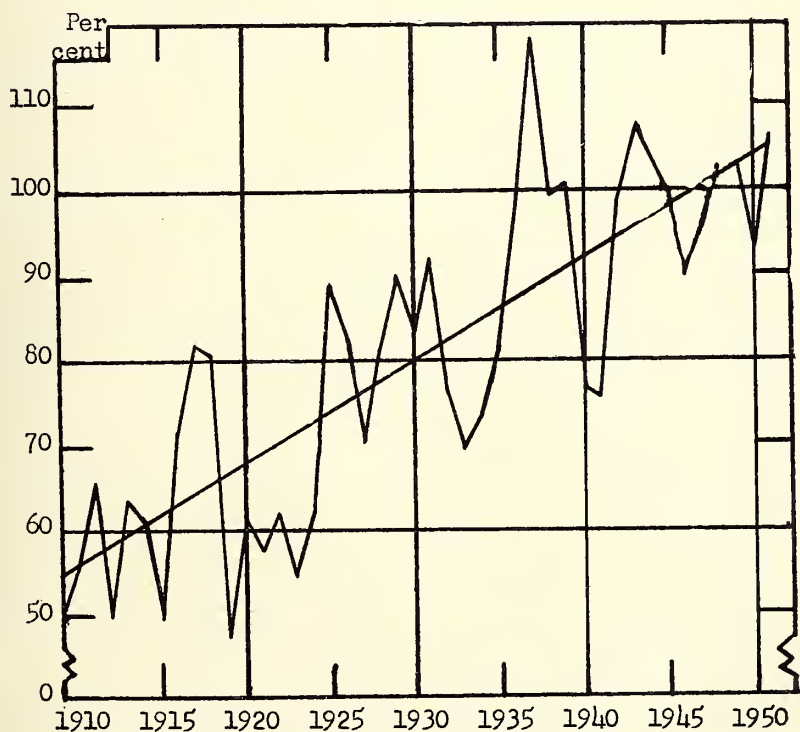


LOUISIANA FARM PRODUCTS

Quantity Sold, Prices, Cash Income from Sales, And Purchasing Power, 1909-1952

By
J. P. MONTGOMERY

Composite Index of the Volume of Sales of Agricultural
Products, Louisiana, 1909-1952
(1935-1939=100)



While the volume of sales of agricultural products varies widely from year to year, the long-time trend in volume sold is sharply upward (from Table 2).

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
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LOUISIANA FARM PRODUCTS

Quantity Sold, Prices, Cash Income From Sales, and Purchasing Power, 1909-1952

J. P. MONTGOMERY

Department of Agricultural Economics
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Louisiana State University

To meet an ever-increasing need for more state statistics on agriculture showing long-time trends, this compilation has been made for Louisiana from releases by the Louisiana Cooperative Crop Reporting Service. The Crop Reporting Office in Louisiana represents both the United States Department of Agriculture and Louisiana State University. Formal cooperation exists between the Department of Agricultural Economics of the University and the Louisiana Office of Agricultural Estimates, Bureau of Agricultural Economics, United States Department of Agriculture. The tables were compiled from established series which are released regularly by the Louisiana Cooperative Crop Reporting Service or by the Department of Agriculture from Washington and therefore could be kept up to date.

Louisiana farmers have made much progress from many viewpoints since 1909. The standard of living of farmers has improved to an extent far beyond the expectations of technicians of 40 or even of 30 years ago. Cash income from farm marketings by Louisiana farmers amounted to \$121,484,000 in 1924 as compared with \$426,369,000 in 1952. This represents an increase from this source of \$304,885,000, or 251 per cent, in 30 years. The per farm cash income from farm marketings averaged approximately \$915 in 1924 as compared with \$3,550 in 1952. When these incomes are reduced to indexes of purchasing power on a basis of variations in prices paid by farmers for the goods and services they secure for their money, it is found that farmers' income in 1924 would have secured 86 per cent of the average secured in 1935-39, whereas the income from farm marketings in 1952 was sufficient to buy 166 per cent of the average in 1935-39. This indicates that the goods and services that Louisiana farmers were able to buy with the income from the sales of their agricultural products in 1952 was almost double the amount they could buy with the income from the sales in 1924.

Modern conveniences in Louisiana farm homes are becoming the rule rather than the exception. There is little difference between the modern farm home and the city home from the standpoint of standard of living as well as home equipment and conveniences. Electric power and telephone lines transverse most of the farm communities of the state. Good radio sets are found in most farm homes and television sets are found in many, also. Hard surface roads are available to most

farms. There is little if any difference in religious, educational, and recreational facilities for rural and urban families.

Use of Cropland

The agricultural enterprise presents an ever-changing picture in Louisiana. Variations in total acres devoted to cash crop production are small from year to year (Figure 1). Variations over the longer period of time are much greater. There was a tendency to increase acres in crops from 1909 through 1938, after which time there have been almost continuous reductions in crop acreages. The number of acres for particular crops varies from year to year and over the years. Total acres devoted to the production of the 36 field crops included in this study increased 820,860, or 23 per cent, from an average of 3,563,400 in the 1909-13 period to an average of 4,384,260 acres in 1934-38. Total acreage devoted to field crop production declined almost continuously from 1937 through 1952. Total acreage in crops averaged 1,309,164, or more than 27 per cent, less in 1948-52 than in 1934-38, and 488,307 fewer acres, or more than 13 per cent less, than the average in 1909-13 (Table 1).

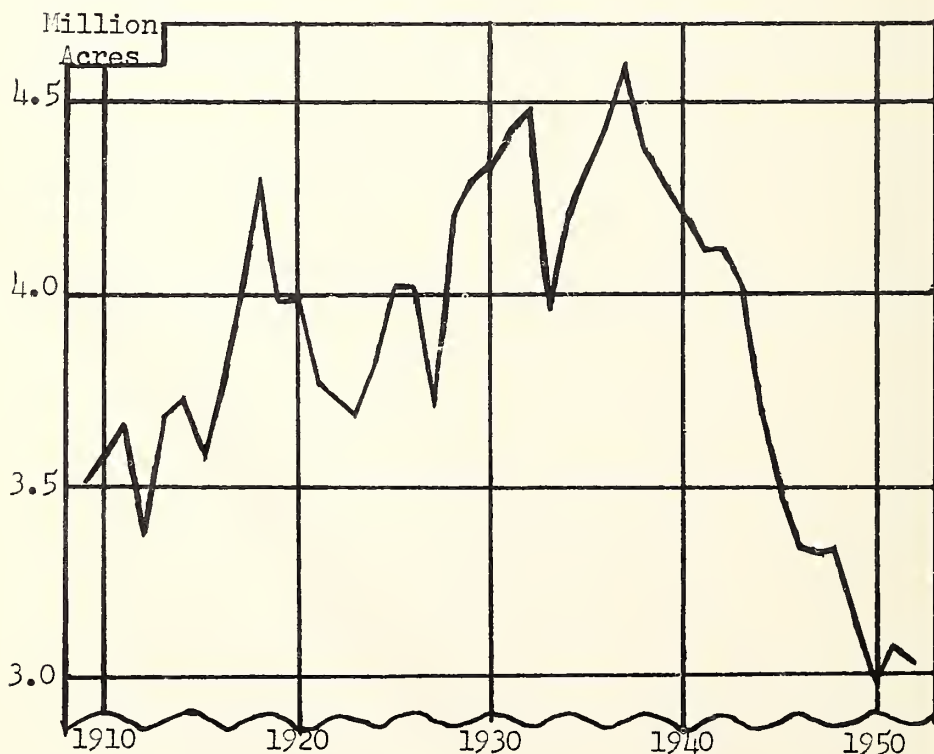


Figure 1. Land used in the production of selected crops, Louisiana, 1909-1952 (from Louisiana Bulletin No. 444).

LOUISIANA FARM PRODUCTS

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Table 1. - Land used in the production of selected crops, Louisiana, 1909-1952

Crop	1909- 1913 average	1914- 1918 average	1919- 1923 average	1924- 1928 average	1929- 1933 average	1934- 1938 average	1939- 1943 average	1944- 1948 average	1949- 1952 average
----- Thousand Acres -----									
Cotton	955.60	1191.20	1168.60	1648.00	1739.00	1309.20	1049.40	792.00	872.50
Sugarcane (Sugar)	302.80	259.00	266.60	176.60	204.60	266.00	265.20	276.20	291.25
Sugarcane (Sirup)	30.44	41.72	22.40	29.80	22.00	25.60	26.40	32.80	10.25
Sorghum (Sirup)					1.60		2.00	4.00	1.80
Rice	349.00	438.00	559.40	470.20	444.80	463.40	543.20	595.60	586.00
Cowpeas (Peas)				28.00	41.20	65.40	56.80	19.00	12.75
Corn (All)	1630.40	1608.00	1443.60	1201.00	1336.40	1589.80	1440.20	1021.00	741.75
Corn (Hybrid)							15.20	99.20	261.25
Oats	33.40	51.80	32.20	13.80	21.40	48.80	91.20	112.60	52.25
Hay (All)	178.80	195.20	214.00	200.40	241.20	300.40	331.20	314.00	306.25
Velvet beans				37.80	42.00	62.60	88.60	22.80	3.50
Soy beans (Beans)				15.20	13.20	12.60	30.40	25.60	34.75
Peanuts (Nuts)	4.40	7.20	7.40	6.60	10.40	11.20	14.80	4.40	2.75
Irish Potatoes	21.60	23.80	22.40	32.00	37.80	41.40	44.40	34.20	12.65
Sweetpotatoes	57.00	62.00	66.20	64.20	83.80	111.40	96.60	104.20	90.00
Tobacco (Periqu)			.90	.40	.44	.26	.44	.38	.35
Stringbeans		1.40	1.56	5.46	7.30	9.14	7.74	5.88	4.25
(Spring)									
Stringbeans			.50	2.84	3.30	4.96	3.18	2.56	2.02
(Fall)									
Cabbage		1.40	1.65	2.80	3.20	4.54	4.92	7.12	3.82
(Commercial)									
Watermelons						4.06	3.72	3.50	2.95
(Commercial)									
Beets				2.85	2.24	1.66	.90	.52	.19
Cucumbers				.80	.86	.79	.96	1.10	.92
(Spring)									
Cucumbers			.25	.64	.55	.53	.55	.88	.61
(Fall)									
Tomatoes				1.40	1.46	2.72	3.12	2.12	1.38
Onions		1.56	1.07	2.39	1.25	1.46	1.68	1.72	.81
Garlic					.50	.61	.89	.90	.39
Shallots						2.75	2.20	2.08	2.00
(Winter)									
Shallots (Fall)						3.10	2.68	2.68	3.00
Eggplant				.52	.55	.60	.57	.39	.30
Green peppers				1.65	1.10	1.28	1.21	1.57	2.31
(Fall)									
Carrots			1.22	2.93	2.22	2.00	1.94	1.42	.79
Spinach				1.84	1.58	1.22	1.22	.86	.46
uck crops				3.64	2.97	2.71	4.30	3.93	1.68
(Processing)									
Strawberries		4.90	8.91	17.55	21.66	18.52	20.40	16.10	15.55
White clover									
seed						8.43	9.40	10.28	11.28
Lespedeza									
seed				9.68	4.14	3.10	7.90	7.30	1.87
Five year									
average	3563440	3887180	3818870	3980970	4294730	4384260	4162320	3429290	3075093
(Acres)	1909	1914	1919	1924	1929	1934	1939	1944	1949
Total cropland ^{1/}									
harvested	3585619	- - -	3924267	3484753	4068161	3977024	4051670	3490139	3148881
(Acres)									

^{1/} Census of Agriculture Reports, U. S. Bureau of the Census.

Among the factors contributing to the decline in acreage devoted to field crop production since 1938, attention is called to the increasing scarcity of farm labor and ever-increasing farm wage rates (farm wage rates in 1953 are about four and one-half times the rates in 1938); the very great expansion in the livestock enterprise, particularly in numbers of beef type cattle, and in the dairy industry; improvement in farm management practices which has led to retirement of great amounts of inferior cropland to timber production or to improved pastures; and the material reduction in the number of workstock on farms as a result of extensive mechanization, resulting in reduction in the acreage devoted to corn production. Corn was produced on an average acreage of 1,630,400 in 1909-13 as compared with an average of 773,800 acres in 1948-52. This represents a decline of more than 52 per cent since 1909 in the amount of land used in corn production.

The average acreage devoted to cotton production in 1909-13 was 955,600. The cotton acreage increased to an average of 1,739,000 in 1929-33 from which high it declined to an average of 792,000 acres in 1944-48 and then increased to an average of 872,500 acres in 1949-52. This means that there was only about half as much land used in cotton production in 1949-52 as was used in 1929-33.

There has been less variation from year to year in the amount of land used in rice production than in the amount used in the production of other major crops. The five-year average acreage devoted to rice production in 1909-13 was 349,000. This increased gradually to an average of 595,600 acres in 1944-48 and then declined slightly to an average of 590,600 acres in 1949-52. The average acreage of rice in Louisiana increased almost 70 per cent from 1909-13 to 1949-53. The rice acreage was not below 544,000 in any year from 1941 through 1953.

The sugar cane enterprise was rather stable from 1909 through 1925 as shown by the fact that the highest acreage in that period was 336,000 in 1911 and the lowest was 233,000 acres in 1919. Acreage of sugar cane (for sugar) dropped sharply from 236,000 acres in 1925 to 161,000 in 1926 and further to 89,000 in 1927, a decline of more than 62 per cent in two years. Sugar cane acreage was under 200,000 each year from 1926 through 1932. Acreage increased gradually after 1932. The highest acreage of sugar cane for sugar since 1911 was attained with the 301,000 acres in 1949. The five-year average in 1948-52 was 292,600 acres, which was 10,200, or about three per cent, fewer acres of sugar cane than the average of 302,800 acres in 1909-13.

Volume of Sales

One of the most noticeable changes in the farm situation in Louisiana since 1910 is the decline in the number of subsistence farms and the increasing tendency to make the farm and the farming operation an economic enterprise rather than a way of life. According to reports of the United States Bureau of the Census, Louisiana's farm labor force

including the farmers, farm family labor, and hired labor used in agricultural production declined 43 per cent from 1910 to 1950; furthermore, this decline is showing no inclination to end. From the production of this smaller labor force and from fewer acres of crops, farmers sold an average of 79 per cent greater volume of agricultural products in 1948-52 than the average of the quantity sold in 1909-13.

Louisiana farmers increased the volume of sales of agricultural products more rapidly than they increased the volume of production. Changes contributing to this gain in sales over production include the expanding industrial development in the South and in Louisiana in particular, providing alternative employment opportunities for underemployed and surplus labor on farms, thereby resulting in a material decline in farm population and in the farm labor force consuming farm products on the farm; and extensive mechanization which resulted in a reduction in workstock numbers on Louisiana farms from 310,000 in 1910 to 193,000 in 1953, thereby reducing feed requirements for workstock in agricultural production.

Increases in the quantities of livestock and livestock products sold have been much greater since 1924 than the increase in quantity of crops marketed. The index of volume of quantities of livestock and livestock products sold averaged 80.0 (1935-39=100) in the 1924-28 period as compared with an average of 149.0 in 1948-52 (Table 2). This represents an increase of 86.3 per cent in the average annual volume of livestock and livestock products sold by Louisiana farmers in the last 30 years. The volume of sales of field crops increased from an average index of 57.2 in 1909-13 to 76.8 in 1924-28 and further to an average index of 93.8 in 1948-52. This represents an increase of 22.1 per cent in the volume of field crops sold from 1924-28 to 1948-52; however, the increase in volume of field crop products sold by Louisiana farmers increased 63.9 per cent from 1909-13 to 1948-52.

The index of volume of meat animals sold by farmers increased from an average index number of 65.2 in 1924-28 to an average of 127.4 in 1948-52, an increase of 95.4 per cent. The index number of volume of dairy products sold by farmers averaged 83.4 in 1924-28 as compared with an average index of volume of sales of 158.8 in 1948-52, an increase of 75.4 index points, or 90.4 per cent, in 25 years. The index numbers of the volume of poultry and eggs sold by Louisiana farmers averaged 141.4 in 1924-28 as compared with an average of 231.8 in 1948-52, an increase of 90.4 points, or 63.9 per cent, in the past 25 years.

Meat Animals

Farmers sold an average of 57,386,000 pounds of beef cattle from 1924 through 1928 as compared with an average of 85,878,600 pounds in 1948-52 (Table 3). This indicates an increase of 28,492,600 pounds, or almost 50 per cent, in Louisiana's beef cattle enterprise since 1924. The cash income from farm marketings of beef cattle averaged \$3,180,800 in 1924-28 and \$20,095,600 in 1948-52. This represents an increase

LOUISIANA FARM PRODUCTS

Table 2. - Indexes of quantities sold by groups of agricultural products,
Louisiana, 1909-1952

(1935-1939 = 100)

Year	All Products	Livestock & livestock products	Meat animals	Dairy products	Wool	Poultry & eggs	Crops	Cotton and seed	Sugar-cane	Food grains	Feed grains and hay	Irish potatoes	Sweet potatoes	Commercial truck crops	Fruit	Pecans
									Per Cent							
1909	50				64		50	33	81	61	128	55	39			66
1910	56				65		56	32	98	65	197	50	39			143
1911	66				76		66	49	114	56	114	62	42			32
1912	50				84		50	49	51	53	53	45	42			231
1913	64				73		64	58	87	53	115	50	48			125
1914	61				86		61	59	67	54	130	52	44			78
1915	50				81		50	45	47	61	115	41	48			106
1916	72				85		72	59	85	99	99	57	52			130
1917	82				87		82	85	85	76	78	65	50			95
1918	81				91		81	78	101	88	56	120	46	51	31	
1919	48				83		48	39	40	91	46	42	56	40	31	
1920	62				84		62	50	51	125	61	78	70	46	38	
1921	58				77		58	36	83	90	60	58	69	57	56	
1922	62				77		62	44	76	96	60	53	64	50	69	
1923	55				78		55	48	53	78	69	59	52	48	61	
1924	63	75	63	77	83	128	60	64	42	74	41	60	29	60	60	
1925	89	78	67	80	85	126	91	120	59	69	48	59	58	97	38	
1926	83	82	67	85	83	142	83	110	24	79	59	66	60	102	84	
1927	71	86	72	87	88	151	67	72	26	99	55	64	81	113	58	
1928	82	79	57	88	92	160	83	92	45	94	65	90	55	109	109	
1929	90	83	60	98	86	150	92	106	62	93	58	52	61	118	101	
1930	83	84	61	94	98	162	83	93	57	95	40	79	50	85	82	
1931	92	75	52	92	101	133	96	117	47	79	76	128	74	95	151	
1932	77	77	63	92	101	105	77	80	56	81	66	63	88	76	125	
1933	70	82	72	94	100	94	67	63	55	79	58	72	75	71	105	
1934	74	85	83	97	98	64	72	65	65	83	52	95	90	100	107	
1935	82	94	100	91	103	76	79	73	83	85	106	87	110	94	69	
1936	98	89	87	94	96	82	100	100	97	104	62	109	96	93	108	
1937	118	96	93	97	97	108	124	143	104	102	108	108	95	103	118	143
1938	100	110	114	108	99	99	98	88	114	103	144	111	103	108	91	84
1939	101	111	106	109	104	135	99	97	102	106	79	85	96	102	114	91
1940	77	115	110	109	106	149	68	59	59	92	93	92	63	94	90	115
1941	76	115	104	115	111	167	66	41	79	100	93	106	113	92	103	66
1942	99	123	101	131	109	201	93	78	92	115	104	99	119	103	129	80
1943	107	132	100	137	95	271	101	96	107	107	87	165	152	85	54	149
1944	104	155	134	141	84	293	92	81	97	105	83	141	172	97	53	185
1945	100	163	161	135	85	248	95	50	118	114	111	99	230	113	73	114
1946	90	164	173	125	79	222	73	32	100	112	125	86	208	106	98	116
1947	97	169	183	132	69	208	79	60	84	117	73	86	143	84	75	65
1948	103	146	142	126	56	223	93	81	94	123	79	49	148	78	73	250
1949	104	153	130	155	42	260	93	85	91	119	78	41	156	74	55	89
1950	94	142	117	156	38	228	82	57	100	127	81	23	197	80	61	110
1951	107	144	121	159	38	216	98	102	81	133	70	21	133	59	42	200
1952	105	160	127	198	44	232	103	97	98	141	71	20	144	77	31	172

of \$16,914,800, or 532 per cent, from 1924 through 1952 in farmers' average annual income from cash marketings of beef cattle. When the cash income from marketings of beef cattle is reduced to purchasing power of the beef cattle enterprise by dividing the index of income from beef cattle by the index of prices paid by farmers for all commodities farmers buy, including interest, taxes, and wage rates, it is found that Louisiana farmers' income from sales of beef cattle averaged an index of purchasing power of 44.4 (1935-39=100) from 1924 through 1928 as compared with an average index of purchasing power of 162 in 1948-52. This indicates that returns from sales of beef cattle in Louisiana averaged almost four times the purchasing power of the cash income from cattle 30 years ago.

Louisiana farmers marketed an average of 40,638,000 pounds of calves from 1924 through 1928 as compared with an average of 112,715,400 pounds in 1948-52, an increase of 71,077,400 pounds, or 175 per cent, in the average annual quantity of calves sold in 1948-52 over the average sold in 1924-28 (Table 4). The gain in cash income from farm marketings of calves has been greater than the gain in the volume sold. The cash income from farm marketings of calves averaged \$2,731,200 dollars in 1924-28 as compared with an average of \$27,506,200 in 1948-52. This represents an increase of \$24,775,000, which is eight times as great an income from this source as that of 1924-28. The index of purchasing power of the income from marketings of calves increased from an average of 107 (1935-39=100) in 1924-28 to an average index of 644 in 1948-52. This indicates that the calf enterprise now provides Louisiana farmers with more than six times the purchasing power that was provided from this source in 1924-28.

The quantity of liveweight hogs marketed by Louisiana farmers averaged 4,873,800 pounds from 1924 through 1928 as compared with average marketings of 9,394,080 pounds in 1948-52 (Table 5). This represents an increase of 4,520,280 pounds, or 93 per cent, in the volume of hogs sold in 1948-52 over the average in 1924-28. The cash income from farm marketings of hogs increased from an average of \$5,277,600 from 1924 through 1928 to an average of \$19,170,400 in 1948-52, an increase of \$13,892,800, or 263 per cent. The index of purchasing power of the returns from sales of hogs increased from 76.6 (1935-39=100) in 1924-28 to 168.8 in 1948-52. This represents an increase since 1924 of 92.2 index points, or 120 per cent, in the purchasing power of Louisiana farmers' annual sales of hogs.

Louisiana farmers sold an average of 1,403,000 pounds of sheep from 1924 through 1928 as compared with an average of 1,009,600 pounds in 1948-52 (Table 6). This represents a decrease of 28 per cent in the volume of sheep marketed in 1948-52 as compared with the volume sold in 1924-28. The volume of sheep marketed varies greatly from year to year. Indications are that sheep production will decline in economic importance in Louisiana in the future.

The volume of lamb sales by farmers averaged 1,263,000 pounds in 1924-28 as compared with an average of 739,800 pounds in 1948-52 (Table 7). This represents a decline of 523,200 pounds, or 41 per cent, from 1924-28 to 1948-52 in the volume of lambs marketed by Louisiana farmers.

Dairy Products

Louisiana farmers sold an average of 1,032,000 cwt. of milk in the wholesale market from 1924 through 1928 as compared with an average of 3,638,000 cwt. in 1948-52 (Table 8). This represents an increase of 253 per cent in the volume of milk sold annually at wholesale by farmers in the past 25 years. The purchasing power provided farmers by the sales of milk in 1924-28 averaged 75.6 (1935-39=100) as compared with an average index of purchasing power of 371.4 in 1947-51. This represents a gain of 295.8 points, or 391.3 per cent, in the purchasing power of the cash income from wholesale milk sales in the past 25 years.

Farmers sold an average of 31,600,000 quarts of milk at retail in 1924-28 as compared with an average of 22,400,000 quarts in 1948-52 (Table 9). The material decline in sales in the retail market is not so significant when it is realized that the loss is made up in the increase in sales of milk at wholesale.

Sales of butter averaged 610,000 pounds from 1924 through 1928 as compared with an average of 380,000 pounds in 1947-51 (Table 10). This represents a decline of 37 per cent in the volume of butter sold by Louisiana farmers since 1924. It is probable that butter sales will continue to decline because acceptable substitutes can be produced much more cheaply than can butter. The Bureau of Agricultural Economics discontinued reporting the butter series in 1952.

Farmers sold an average of 424,000 pounds of butterfat from 1924 through 1928 as compared with an average of 116,000 pounds in 1948-52 (Table 11). This represents a 72.6 per cent decline in the volume of sales of butterfat since 1924.

Farmers sold an average of 541,000 pounds of wool from 1909 through 1913 as compared with an average of 324,600 pounds in 1948-52 (Table 12). This indicates that Louisiana farmers are marketing 40 per cent less wool now than they sold 40 years ago.

Poultry and Eggs

Louisiana farmers marketed an average of 9,027,800 pounds of chickens from 1924 through 1928 as compared with average sales of 12,394,600 pounds in 1948-52 (Table 13). This indicates an increase of 37 per cent in the average annual sales of chickens since 1924-28.

Commercial broiler production gained prominence in Louisiana in the late thirties. The Office of Agricultural Estimates has reported on broiler production since 1939 when the volume amounted to 1,100,000 pounds (Table 14). Expansion in broiler production was rapid and fairly regular from 1939 to 1950 when 5,794,000 pounds was reported.

The volume was 12,620,000 pounds in 1951 and 22,716,000 in 1952.

Farmers sold an average of 376,800 pounds of turkeys from 1929 through 1933 as compared with an average of 962,600 pounds in 1948-52 (Table 15). This represents an increase of 155 per cent in the annual sales of turkeys since 1929-33.

The annual sales of eggs averaged 11,533,800 dozen in 1924-28 as compared with an average of 21,316,100 dozen in 1948-52 (Table 16). This represents an increase of 85 per cent in the annual sales of eggs since 1924-28. The index of purchasing power of the income from sales of eggs increased from an average of 126 in 1924-28 to an average of 230 in 1948-52. This represents an increase of 104 points, or 83 per cent, in the purchasing power from the sales of eggs since 1924-28.

Field Crops

The index numbers of volume of cotton and cotton seed sold by Louisiana farmers averaged 44.2 (1935-39=100) in 1909-13 as compared with an average index of 91.6 in 1924-28, and with an average index of 84.4 in 1948-52 (Table 2). This represents an increase of 47.4 index points, or 107.2 per cent, in the volume of cotton sold from 1909-13 to 1924-28 and then a decline of 7.9 per cent in the volume sold from 1924-28 to 1948-52. The volume of cotton sold varies widely from year to year. These fluctuations are caused not only by variations in cotton acreage but also by differences in weather conditions from year to year, differences in extent of plant diseases and insect infestation, and variations in quantity and quality of fertilizer used in cotton production.

The volume of cotton sold by Louisiana farmers varied widely from year to year and over the years from 1909 through 1952 (Table 17). The average annual sales of cotton were 340,800 bales in the five-year period 1909-13. The volume sold by farmers increased irregularly to an average of 768,400 bales in 1935-39. The average quantity of cotton sold in 1948-52 was 634,200 bales, or 17.5 per cent less than the average annual sales in 1935-39. The quantity of cotton sold in 1948-50 was more than 86 per cent greater than the quantity sold in 1909-13. This much greater quantity in the most recent years was produced on 8 per cent fewer acres of harvested cotton land. There has been a drastic decline in cotton acreage on low-yielding hill land accompanied by a somewhat smaller increase in cotton acreage on the more fertile bottom lands of the state.

The quantity of cotton seed sold varies directly with variations in the quantity of cotton lint production (Table 18). The range in quantities of cotton seed sold from 1909 through 1952 was from 7,500 tons in 1910 to 380,000 tons in 1937. The quantity of cotton seed sold averaged 108,000 tons in 1909-13 as compared with an average of 230,000 tons in 1948-52. This represents an increase of 113 per cent in volume sold in the 44 years.

The volume of rice sold by Louisiana farmers ranged from 9,720,000 bushels in 1912 to 27,415,000 bushels in 1952 (Table 19). The index of

volume sold averaged 57.6 in 1909-13 (1935-39=100) as compared with an average index of 128.4 in 1948-52. This indicates an increase of 123 per cent from 1909 to 1952 in the amount of rice sold annually.

Sugar cane producers have experienced more problems pertaining to plant diseases and insect infestations than have producers of most other crops. There were wide fluctuations in the volume of sugar cane (for sugar) sold by farmers from 1909 through 1952 (Table 20). Farmers sold an average of 4,307,800 tons of sugar cane in 1909-13. Volume of sales in that five-year period varied from a high of 5,587,000 tons in 1911 to 2,163,000 in 1912. The smallest tonnage from 1909 through 1952 was 864,000 in 1926. Through the introduction of improved varieties in the late twenties and a continuous varietal improvement program there has been a tendency to solve many of the production problems encountered, and as a result the volume of sugar cane sold has increased. The average volume sold in the last five years (1948-52) was 5,083,200, which was 775,400 tons, or 17.7 per cent, more than the average sold in 1909-13.

Louisiana farmers sold an average of 5,460,600 gallons of sugar cane sirup in the years 1909 through 1913 (Table 21). The demand for sirup increased greatly in World War I and again in World War II owing to serious shortages of sugar. Sugar cane sirup sales amounted to 13,644,000 gallons in 1918 and then declined to 3,474,000 gallons in 1919. The greatest volume of sales of sirup in the World War II period was the 13,275,000 gallons sold in 1945. Indications in the most recent five-year period are that the sugar cane sirup industry is being displaced by other more profitable agricultural enterprises. The volume of sales of sugar cane sirup averaged only 2,246,000 gallons in 1948-52, or 41 per cent of the volume sold in 1909-13.

Sorghum cane sirup is produced in some sections of Louisiana; however, it is produced most often in small plots for home use. Data on quantities sold are not available prior to 1939. Since 1939, quantities of sorghum cane sirup sold ranged, with one exception, between 21,000 and 42,000 gallons (Table 22). It is probable that production of sorghum cane for sirup will continue, primarily, for home consumption on the farm where produced, with the small surplus going into the market. Such small quantities have been reported sold in recent years that the Crop Reporting Service has discontinued reporting sorghum cane sirup.

Louisiana farmers sold an annual average of 2,223,200 bushels of corn in 1909-13 as compared with an average of 966,400 in 1948-52, a decline of 56.7 per cent in the quantity of corn sold from 1909 to 1952 (Table 23). Corn is not considered a major cash crop in Louisiana, and indications are that it will be of even less importance in future years because most farmers are able to produce other crops that will provide greater monetary returns per acre and per unit of resources input. While corn will continue as part of the farm management rotation practice it is

probable that the acreage will decline further in future years. It should be remembered that Louisiana is not considered a commercial corn producing state. As a matter of fact only 5 to 8 per cent of the corn produced in Louisiana is sold, 92 to 95 per cent of the production being used on the farm where it is produced.

Relatively few Louisiana farmers produce oats for sale. The quantity sold by farmers from 1909 through 1913 ranged from 26,000 to 43,000 bushels, with an average of 31,000 bushels reported as sold (Table 24). The volume sold increased materially from 1935 to 1945, since which time there has been a tendency to reduce the quantity sold. The average quantity sold from 1941 through 1945 was 683,400 bushels as compared with an average of 270,600 bushels in 1948-52, a decline of 60.4 per cent since 1945.

Louisiana is a deficit area in hay production the same as in feed grains. Only small quantities are sold and usually what is sold is in small lots (Table 25). When a farmer has a surplus over his needs he usually sells this to some of his neighbors. Great amounts of various kinds of stock feed are imported into the state each year.

Soybeans are produced more commonly as a cover crop or for hay than as a commercial seed operation in Louisiana. The volume of soybeans sold by farmers averaged 96,200 bushels in 1909-13 (Table 26). The volume sold fluctuates widely from year to year and over the years. The range in volume sold was from 27,000 bushels in 1935 to 616,000 bushels in 1950. The tendency has been for greater volume of sales since 1940. The average annual volume sold from 1948 through 1952 was 465,600 bushels, which was almost five times the amount sold in 1909-13.

The volume of cowpeas sold by Louisiana farmers ranged from 9,000 bushels in 1930 to 131,000 bushels in 1925 (Table 27). The average of the five years' annual sales from 1924 through 1928 was 73,400 bushels as compared with an average of 29,000 bushels sold in 1948-52. This indicates a decline of 60.5 per cent from 1924 to 1952 in the volume of cowpeas sold by Louisiana farmers.

Peanuts are produced by relatively few farmers in some hill sections in North Louisiana on a commercial basis. The volume of peanuts sold by farmers in the 1909-13 period averaged 627,200 pounds annually (Table 28). From 1909 through 1952 the volume sold ranged from 180,000 pounds in 1936 to 4,662,000 pounds in 1942, when an intensive drive was made to get farmers to produce oil crops. The volume sold fluctuated widely from 1924 through 1952. The average quantity sold from 1948 through 1952 was 378,000 pounds, or 39.7 per cent less than the quantity sold in 1909-13.

Commercial Irish potato producers sold an average of 972,600 bushels in 1909-13 (Table 29). The volume of sales was fairly stable from 1909 through 1943, after which time it has declined continuously from 2,070,000 bushels in 1943 to 365,000 bushels in 1952. The volume sold in 1948-52 averaged 572,000 bushels, which is 41.2 per cent less than the quantity sold in 1909-13.

The quantity of sweet potatoes sold by Louisiana farmers averaged 1,458,400 bushels in 1909-13 and has increased steadily since that time (Table 30). The volume sold averaged 5,413,000 bushels in 1948-52, an increase of 271 per cent in 44 years.

Perique tobacco is produced in a small area on the east side of the Mississippi River in St. James Parish (county). This has proved to be the only known area in the world where this particular type of tobacco can be produced. Perique is primarily used as a blend in flavoring other tobaccos. There are only a few Perique producers and the acreage is small. The volume of Perique tobacco sold by farmers ranged from 35,000 pounds in 1934 to a high of 478,000 pounds in 1922 (Table 31). The volume sold averaged 404,000 pounds in 1909-13 as compared with an average of 206,800 in 1948-52. This simply means that farmers are selling only about half as much Perique tobacco in recent years as was sold 44 years ago.

The tung nut enterprise is relatively a newcomer in Louisiana as the first sales reported in the state were the 150 tons in 1939. The expansion in the volume of sales of tung nuts was rather rapid as new orchards began coming into production in 1939. Because of the variations in January, February, and March weather conditions from year to year, the crop must be classed as a hazardous one. The volume of sales fluctuates widely from year to year, as illustrated by the 2,900 tons sold in 1951, when there was a severe freeze at the time that the trees were in full bloom, and the 32,000 tons sold in 1952, when the producers had an almost ideal growing season (Table 32). Practically all the commercial production is found in the Florida Parishes (counties). It is doubtful whether there will be any appreciable increase in the acreage of tung nuts in this state in the foreseeable future. Some increase in the volume of tung nuts sold can be expected in favorable growing years because many tung orchards have not grown to full maturity as yet.

Fruits

Louisiana farmers sold an average of 1,071,200 crates (24-pint) of strawberries in 1918-22, the earliest years for which data are available (Table 33). The commercial strawberry area centers along the Illinois Central Railroad which extends across Tangipahoa Parish from north to south. Strawberries are produced less extensively in the nearby parishes of Livingston, Ascension, and St. Helena. The volume of sales of strawberries tended to increase until 1931, when the total volume sold was 3,690,000 crates. The strawberry enterprise has tended to decline in recent years. The average volume of sales in 1948-52 was 1,186,400 crates, or 9.7 per cent more than the average in 1918-22.

Louisiana farmers sold an average of 39,600 boxes (90-pound) of oranges in 1919-23, the first five years for which data are available (Table 34). The volume of sales increased rather steadily up to 394,000 boxes in 1946. A severe freeze in the winter of 1950-51 not only almost destroyed the crop but also did severe damage to the citrus fruit trees.

The volume of sales in 1949 was 354,000 boxes and in 1950 was 285,000 boxes. In 1951 and in 1952 sales amounted to only 45,000 boxes per year. The trees are coming back gradually but it will be several years before volume approaches that of the years preceding the freeze. The commercial orange area is in Plaquemines Parish along the Mississippi River below or to the south of New Orleans.

The volume of peaches sold varies widely from year to year as illustrated by sales in 1909, 1910, 1911, and 1912, when the volume of sales was 131,000, 298,000, 65,000, and 473,000 bushels, respectively. The average quantity sold in 1909-13 was 243,600 bushels (Table 35). The volume sold declined materially over the years and particularly in the last few years. The average quantity sold in 1948-52 was 49,000 bushels, or a decline of 80 per cent in the average volume of peaches sold since 1909-13. The commercial peach producing orchards are located in the hill section of North Louisiana.

There are no farms in Louisiana where pears are considered the major cash crop. The volume of sales is made up of the many cases where there are surplus pears from a few trees on the homestead which are sold a few bushels at a time. The volume of pears reported sold by farmers averaged 17,000 bushels in 1909-13 as compared with an average of 53,800 bushels in 1948-52 (Table 36). The range in the volume of pears sold by farmers from 1909 through 1952 was from 6,000 bushels in 1911 to 185,000 bushels in 1940.

Pecans

The quantity of pecans sold by Louisiana farmers averaged 2,512,600 pounds from 1919 through 1923 as compared with an average of 13,860,000 pounds in 1948-52 (Table 37). This indicates that Louisiana farmers are selling more than five times as many pecans as they sold 30 years ago.

A breakdown between improved (grafted or budded) and wild (seedling) pecans has been made since 1937 (Table 38). The average quantity of improved, or papershell, pecans sold in 1937-41 was 2,058,600 pounds. Average sales in 1948-52 were 3,125,200 pounds, an increase since 1937 of 51.8 per cent in the volume sold.

The average volume of seedling, or wild, pecans sold was 4,888,600 pounds from 1937 through 1941. Average volume in 1948-52 was 10,734,800 pounds, an increase of 120 per cent in 16 years (Table 38). There have been only two years in the last ten in which cash income from farm marketings of pecans was less than \$2,000,000.

Commercial Vegetable and Truck Crops

The index of volume of vegetable and truck crops sold by Louisiana farmers averaged 48.8 (1935-39=100) from 1918 through 1922 as compared with an average index of volume of 71.6 in 1948-52 (Table 2). This indicates that farmers are selling, on the average, 46.7 per cent more vegetables than were sold 25 years ago.

The sales of snap beans in the mid-spring market averaged 123,800 28-pound hampers (often referred to as bushels) from 1918 through 1922 (Table 39). Following 1923 the volume increased sharply for the next several years, after which sales fell off to the point where the average volume sold in 1948-52 was 313,800 hampers. It should be observed that even after the decline of recent years the volume sold in the last five years was 153.4 per cent greater than the volume sold in 1918-22.

The volume of snap beans sold in the early fall market averaged 103,200 hampers in 1922-26 as compared with an average of 142,800 hampers in 1948-52 (Table 40). This indicates an increase of almost 38.4 per cent in the volume of early fall string beans sold on the fresh market by Louisiana farmers.

Farmers sold an average of 8,460 tons of cabbage from 1918 through 1922 as compared with an average of 17,920 tons in 1948-52 (Table 41). This represents an increase of approximately 112 per cent in the average volume of cabbage marketed since 1918.

The number of watermelons sold by farmers averaged 1,176,600 from 1934 through 1938 as compared with an average of 745,000 in 1948-52 (Table 42). This represents a decline of 36.7 per cent in the volume of watermelons sold by Louisiana farmers in the last 15 years.

Farmers sold an average of 325,000 bushels of beets from 1927 through 1931 as compared with an average of 21,400 bushels in 1948-52 (Table 43). The volume sold in 1951 and 1952 declined to 7,000 and 6,000 bushels, respectively. Beet production has declined to the point that it is of little economic importance in the state.

The volume of cucumbers for the late spring market averaged 42,400 bushels from 1923 through 1927 as compared with an average of 60,800 bushels in 1948-52 (Table 44).

Farmers sold an average of 68,400 bushels of cucumbers on the early fall market from 1928 through 1932 as compared with average sales of 80,800 bushels in 1948-52 (Table 45).

The quantity of tomatoes sold in the fresh market averaged 119,400 bushels from 1925 through 1929 as compared with an average of 100,600 bushels in 1948-52 (Table 46).

Louisiana farmers sold an average of 232,000 sacks (50-pound) of onions from 1918 through 1922 as compared with an average of 84,800 sacks in 1948-52 (Table 47). There was a great decline in the volume of onions sold—from 114,000 sacks in 1950 to 36,000 in 1951 and further to 32,000 in 1952.

The volume of garlic marketed averaged 720,000 pounds from 1932 through 1936 as compared with average sales of 600,000 pounds in 1948-52 (Table 48). Garlic sales amounted to only 100,000 pounds in 1951 and again in 1952.

Farmers sold an average of 283,300 bushels of shallots in the early spring market from 1937 through 1941 as compared with average sales of

196,400 in 1948-52 (Table 49). The quantity sold in 1937-41 was 44.5 per cent greater than the amount sold in 1948-52.

Shallots sold in the winter market averaged 301,800 bushels from 1937 through 1941 as compared with average sales of 297,200 bushels in 1948-52 (Table 49).

The quantity of eggplant marketed averaged 84,800 bushels from 1925 through 1929 as compared with average sales of 47,400 bushels in 1948-52 (Table 50).

An average of 260,000 bushels of green peppers were marketed from 1924 through 1928 as compared with an average of 330,800 bushels in 1948-52 (Table 51).

The quantity of carrots marketed by farmers averaged 569,400 bushels from 1923 through 1927 as compared with an average of 80,000 bushels in 1948-52 (Table 52). This represents a decline of more than 85 per cent in the volume of carrots sold by farmers in the last 30 years. Indications are that commercial carrot production is a disappearing enterprise.

Spinach marketed from 1925 through 1929 averaged 195,400 bushels as compared with an average of 34,400 bushels in 1948-52 (Table 53). This seems to be another disappearing enterprise from the standpoint of a commercial product since the quantity marketed in 1948-52 was only 17.6 per cent of the volume marketed 25 years ago.

The volume of truck crops sold to commercial processing plants averaged 3,360 tons from 1928 through 1932 as compared with 2,152 tons in 1948-52 (Table 54). This indicates a decline of approximately one-third in the last 25 years in the volume of truck crops for processing sold by farmers.

LOUISIANA FARM PRODUCTS

Table 3. - Beef cattle: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (cwt)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	273.18	23	4.65	99	1,270	23	128	18
1925	570.31	48	4.70	100	2,680	48	131	37
1926	565.61	47	4.70	100	2,658	47	128	37
1927	853.52	71	5.70	121	4,865	87	127	69
1928	606.68	51	7.30	155	4,429	79	129	61
1929	628.15	52	7.30	155	4,585	82	128	64
1930	746.97	62	5.80	123	4,332	77	121	64
1931	624.46	52	4.70	100	2,935	52	104	50
1932	427.32	36	3.65	77	1,560	28	89	31
1933	620.81	52	3.15	67	1,956	35	87	40
1934	526.15	44	3.45	73	1,815	32	96	33
1935	1,462.36	122	4.20	89	6,142	109	99	110
1936	966.83	81	4.50	96	4,351	77	99	78
1937	1,075.36	90	5.00	106	5,377	96	105	91
1938	1,399.02	117	4.65	99	6,505	116	99	117
1939	1,097.99	91	5.20	110	5,710	102	98	104
1940	1,246.54	104	5.50	117	6,856	122	99	123
1941	1,169.47	97	6.80	144	7,952	142	105	135
1942	823.41	69	8.40	178	6,917	123	121	102
1943	719.22	60	10.20	217	7,336	131	136	96
1944	912.62	76	9.20	195	8,396	149	145	103
1945	1,748.88	146	10.30	219	18,013	321	151	213
1946	2,007.12	167	12.00	255	24,085	429	165	260
1947	2,324.47	194	14.50	308	33,705	600	192	312
1948	1,367.13	114	18.60	395	25,429	453	207	219
1949	925.58	77	17.70	376	16,383	292	200	146
1950	548.64	46	19.70	418	10,808	192	204	94
1951	747.63	62	23.60	501	17,644	314	225	140
1952	704.95	59	20.30	431	14,310	255	229	211

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Table 4. - Veal calves: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (cwt)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	639.22	188	5.50	94	3,516	177	128	138
1925	386.09	114	6.00	102	2,317	116	131	89
1926	327.79	97	6.50	111	2,131	107	128	84
1927	328.88	97	7.20	123	2,368	119	127	94
1928	349.92	103	9.50	162	3,324	167	129	129
1929	316.65	93	9.70	166	3,072	154	128	120
1930	226.08	67	8.20	140	1,854	93	121	77
1931	289.34	85	6.00	102	1,736	87	104	84
1932	485.88	143	4.30	73	2,089	105	89	118
1933	300.59	89	4.15	71	1,247	63	87	72
1934	563.85	166	4.10	70	2,312	116	96	121
1935	229.64	68	5.30	90	1,217	61	99	62
1936	440.42	130	5.40	92	2,378	119	99	120
1937	383.64	113	6.10	104	2,340	118	105	112
1938	288.23	85	5.90	101	1,701	85	99	86
1939	354.31	104	6.60	113	2,338	117	98	119
1940	379.71	112	6.80	116	2,582	130	99	131
1941	421.93	124	8.60	147	3,629	182	105	173
1942	529.09	156	10.60	181	5,608	282	121	233
1943	621.58	183	12.00	205	7,459	375	136	276
1944	740.08	218	11.20	191	8,289	417	145	288
1945	771.52	227	12.20	208	9,413	489	151	324
1946	1,035.83	305	14.80	253	14,916	750	165	455
1947	935.13	276	18.40	314	17,206	865	192	451
1948	927.67	273	22.90	391	21,243	1,067	207	515
1949	1,041.62	307	21.40	365	22,290	1,120	200	560
1950	1,103.96	325	24.50	418	27,047	1,359	204	666
1951	1,177.27	347	29.10	497	34,259	1,722	225	765
1952	1,385.25	408	23.60	403	32,692	1,639	229	716

LOUISIANA FARM PRODUCTS

Table 5. - Hogs: Volume sold, season-average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952
(1935-1939 = 100)

Year	Quantity sold (cwt) ^{1/}	Index of quantity sold	Season average price	Index of prices	Income from sales ^{2/}	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars		per cent	
1924	505.80	71	7.40	123	4,723	88	128	69
1925	543.60	76	8.80	146	5,949	111	131	85
1926	603.00	84	9.40	156	6,898	129	128	101
1927	451.50	63	9.20	153	5,281	98	127	77
1928	333.00	46	7.90	131	3,537	66	129	51
1929	415.50	58	7.90	131	4,135	77	128	60
1930	412.50	58	7.60	126	3,955	74	121	61
1931	270.00	38	6.10	101	2,551	48	104	46
1932	483.00	67	4.30	71	2,841	53	89	60
1933	663.00	93	3.60	60	2,986	56	87	64
1934	756.00	105	4.00	66	3,735	70	96	73
1935	568.50	79	5.80	96	4,383	82	99	83
1936	573.00	80	6.40	106	4,892	91	99	92
1937	651.20	91	6.70	111	5,533	103	105	98
1938	872.85	122	5.90	98	6,169	115	99	116
1939	918.00	128	5.30	88	5,847	109	98	111
1940	851.70	119	4.60	76	4,731	88	99	89
1941	763.00	106	7.00	116	6,506	121	105	115
1942	894.25	125	10.50	174	11,006	205	121	169
1943	875.80	122	12.20	203	12,816	239	136	176
1944	1,322.40	185	10.40	173	15,440	288	145	199
1945	1,142.52	159	12.30	204	16,092	300	151	199
1946	938.93	131	15.20	252	16,935	316	165	192
1947	969.40	135	20.70	344	23,175	432	192	225
1948	934.10	130	21.10	350	22,686	423	207	204
1949	988.07	138	17.50	291	19,534	364	200	182
1950	982.30	137	16.60	276	18,229	340	204	167
1951	847.85	118	18.70	311	17,861	333	225	148
1952	944.72	132	17.10	284	17,542	327	229	143

^{1/} Excludes interfarm sales.

^{2/} Includes receipts from marketings and receipts from farm slaughtered meat.

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Table 6. - Sheep: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)								
Year	Quantity sold (cwt)	Index of sold quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	7.19	56	5.10	135	36.7	79	128	62
1925	17.06	132	6.30	167	107.5	232	131	177
1926	11.84	91	5.40	143	63.9	138	128	108
1927	20.97	162	5.70	151	119.5	258	127	203
1928	13.09	101	6.90	183	90.3	195	129	151
1929	14.85	115	6.70	177	99.5	215	128	168
1930	9.94	77	5.70	151	56.6	122	121	101
1931	14.57	113	4.30	114	62.7	135	104	130
1932	13.90	107	3.40	90	47.3	102	89	115
1933	13.77	106	3.05	81	42.0	91	87	105
1934	7.46	58	3.05	81	22.8	49	96	51
1935	34.00	263	3.35	89	113.9	246	99	248
1936	3.64	28	3.95	104	14.4	31	99	31
1937	4.07	31	4.05	107	16.5	36	105	34
1938	11.13	86	3.80	101	42.3	91	99	92
1939	11.89	92	3.75	99	44.6	96	98	98
1940	23.12	179	4.00	106	92.5	200	99	202
1941	12.02	93	4.25	112	51.1	110	105	105
1942	26.75	207	5.40	143	144.5	312	121	258
1943	20.93	162	6.20	164	129.8	280	136	206
1944	14.58	113	6.20	164	90.4	195	145	134
1945	2.17	17	6.50	172	14.1	30	151	20
1946	38.98	301	6.90	183	268.9	580	165	352
1947	28.81	223	7.10	188	204.6	442	192	230
1948	32.43	250	8.80	233	285.4	616	207	298
1949	12.03	93	9.00	238	108.3	234	200	117
1950	0.84	6	10.30	272	8.6	19	204	9
1951	3.39	26	12.60	333	42.7	92	225	41
1952	1.79	14	10.60	280	19.0	41	229	18

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Table 7. - Lambs: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

Year	Quantity sold (cwt)	Index of quantity sold	Season average price	Index of prices	Income from sales	(1935-1939 = 100)		
						of income	Index of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	16.11	78	6.60	120	106.3	94	128	73
1925	12.04	58	8.10	148	97.5	86	131	66
1926	9.46	46	7.30	133	69.1	61	128	48
1927	12.43	60	7.60	139	94.5	83	127	65
1928	13.11	63	8.90	162	116.7	103	129	80
1929	14.39	70	9.00	164	129.5	114	128	89
1930	17.58	85	7.30	133	128.4	113	121	93
1931	10.67	52	6.50	119	69.3	61	104	59
1932	20.42	99	4.15	76	84.7	75	89	84
1933	31.19	151	4.20	77	131.0	115	87	132
1934	23.00	111	3.75	68	86.2	76	96	79
1935	17.42	84	5.00	91	87.1	77	99	78
1936	19.59	95	5.80	106	113.6	100	99	101
1937	21.73	105	5.50	100	119.5	105	105	100
1938	21.02	102	5.60	102	117.7	104	99	105
1939	23.71	115	5.50	100	130.4	115	98	117
1940	16.88	82	5.60	102	94.5	83	99	84
1941	15.32	74	6.00	109	91.9	81	105	77
1942	13.50	65	7.30	133	98.6	87	121	72
1943	14.91	72	8.40	153	125.2	110	136	81
1944	11.50	56	8.40	153	96.6	85	145	59
1945	19.37	94	9.70	177	187.9	165	151	109
1946	9.82	47	11.00	201	108.1	95	165	58
1947	10.99	53	13.60	248	149.4	131	192	68
1948	11.04	53	15.00	274	165.6	146	207	71
1949	9.37	45	16.30	297	152.7	134	200	67
1950	6.24	30	17.20	314	107.4	94	204	46
1951	3.19	15	23.60	431	75.3	66	225	29
1952	7.15	34	22.40	409	160.1	141	229	61

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Table 8. - Milk, wholesale: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

Year	Quantity sold (cwt)	Index of quantity sold	Season average price	Index of prices	Income from sales	(1935-1939 = 100)		
						of income	Index	
							of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	880	63	3.00	142	2,640	89	128	70
1925	970	69	2.70	128	2,619	88	131	67
1926	1,080	77	2.80	133	3,024	102	128	80
1927	1,110	79	2.70	128	2,997	101	127	80
1928	1,120	80	2.75	130	3,080	104	129	81
1929	1,340	96	2.75	130	3,685	124	128	97
1930	1,300	93	2.55	121	3,315	112	121	93
1931	1,200	86	2.10	100	2,520	85	104	82
1932	1,120	80	1.45	69	1,624	55	89	62
1933	1,220	87	1.50	71	1,830	62	87	71
1934	1,300	93	1.70	81	2,210	75	96	78
1935	1,160	83	1.95	92	2,262	76	99	77
1936	1,260	90	2.10	100	2,646	89	99	90
1937	1,340	96	2.25	107	3,015	102	105	97
1938	1,610	115	2.15	102	3,462	117	99	118
1939	1,640	117	2.10	100	3,444	116	98	118
1940	1,660	118	2.30	109	3,818	129	99	130
1941	1,900	136	2.45	116	4,655	157	105	150
1942	2,360	168	3.00	142	7,080	239	121	198
1943	2,600	185	3.65	173	9,490	320	136	235
1944	2,740	195	3.75	178	10,275	346	145	239
1945	2,590	185	3.80	180	9,972	336	151	223
1946	2,450	175	4.93	234	12,078	407	165	247
1947	2,670	190	5.71	271	16,274	549	192	286
1948	2,540	181	6.26	297	20,345	686	207	331
1949	3,700	264	5.75	273	21,275	717	200	358
1950	3,900	278	5.61	266	21,879	738	204	362
1951	4,100	292	6.14	291	25,174	849	225	377
1952	4,450	318	6.55	310	29,148	983	229	429

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Table 9. - Milk, retail: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (qts)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	31,000	96	.126	128	3,906	122	128	95
1925	31,000	96	.123	124	3,813	119	131	91
1926	32,000	99	.130	132	4,160	130	128	102
1927	32,000	99	.134	136	4,288	134	127	106
1928	32,000	99	.134	136	4,288	134	129	104
1929	33,000	102	.130	132	4,290	134	128	105
1930	32,000	99	.128	130	4,096	128	121	106
1931	32,000	99	.112	113	3,584	112	104	108
1932	32,000	99	.093	94	2,976	93	89	104
1933	32,000	99	.093	94	2,976	93	87	107
1934	33,000	102	.095	96	3,138	98	96	102
1935	32,000	99	.098	99	3,136	98	99	99
1936	32,000	99	.099	100	3,168	99	99	100
1937	32,000	99	.102	103	3,264	102	105	97
1938	33,000	102	.097	98	3,201	100	99	101
1939	33,000	102	.098	99	3,234	101	98	103
1940	33,000	102	.100	101	3,300	103	99	104
1941	32,000	99	.106	107	3,392	106	105	101
1942	33,000	102	.117	118	3,861	121	121	100
1943	33,000	102	.128	130	4,224	132	136	97
1944	34,000	105	.130	132	4,420	138	145	95
1945	33,000	102	.134	136	4,422	138	151	91
1946	30,000	93	.151	153	4,530	142	165	86
1947	30,000	93	.178	180	5,340	167	192	87
1948	29,000	90	.197	199	5,713	178	207	86
1949	24,000	74	.196	198	4,704	147	200	74
1950	21,000	68	.202	204	4,242	133	204	65
1951	19,000	59	.215	218	4,085	128	225	57
1952	19,000	59	.224	227	4,256	133	229	58

Table 10. - Butter: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1951

(1935-1939 = 100)

Year	Quantity sold (lbs.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars		per cent	
1924	500	81	.45	161	225	130	128	102
1925	550	89	.44	157	242	140	131	107
1926	600	97	.43	154	258	149	128	116
1927	700	113	.44	157	308	178	127	140
1928	700	113	.43	154	301	174	129	135
1929	713	115	.42	150	299	173	128	135
1930	600	97	.41	146	246	142	121	117
1931	600	97	.31	111	186	107	104	103
1932	800	129	.23	82	184	106	89	119
1933	600	97	.22	79	132	76	87	87
1934	600	97	.24	86	144	83	96	86
1935	600	97	.28	100	168	97	99	98
1936	600	97	.29	104	174	100	99	101
1937	620	100	.30	107	186	107	105	102
1938	640	103	.27	96	173	100	99	101
1939	635	103	.26	93	165	95	98	97
1940	500	81	.27	96	135	78	99	79
1941	450	73	.31	111	140	81	105	77
1942	430	69	.35	125	150	87	121	72
1943	370	60	.45	161	166	96	136	71
1944	400	65	.45	161	180	104	145	72
1945	500	81	.48	171	240	139	151	92
1946	500	81	.59	211	295	170	165	103
1947	450	73	.64	229	288	166	192	86
1948	400	65	.66	236	264	152	207	73
1949	400	65	.61	218	244	141	200	70
1950	350	56	.58	207	203	117	204	57
1951	300	48	.61	218	183	106	225	47

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Table 11. - Butterfat: Volume sold, season average price received by farmers, cash income sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	320	22	.40	161	128	37	128	29
1925	280	20	.38	153	106	30	131	23
1926	360	25	.40	161	144	41	128	32
1927	520	37	.41	165	213	61	127	48
1928	640	45	.41	165	262	75	129	58
1929	960	67	.41	165	394	113	128	88
1930	800	56	.35	141	280	80	121	66
1931	1,280	90	.24	97	307	88	104	85
1932	1,600	112	.16	65	256	73	89	82
1933	1,560	110	.16	65	250	71	87	82
1934	1,320	93	.19	77	251	72	96	75
1935	1,320	93	.24	97	317	91	99	92
1936	1,320	93	.27	109	356	102	99	103
1937	1,320	93	.29	117	383	109	105	104
1938	1,560	110	.23	93	359	103	99	104
1939	1,600	112	.21	85	336	96	98	98
1940	1,430	100	.25	101	358	102	99	103
1941	1,520	107	.30	121	456	130	105	124
1942	1,480	104	.34	137	503	144	121	119
1943	1,100	77	.41	165	451	129	136	95
1944	630	44	.45	181	284	81	145	56
1945	590	41	.47	190	277	79	151	52
1946	340	24	.54	218	184	53	165	32
1947	340	24	.62	250	211	60	192	31
1948	210	15	.66	266	139	40	207	19
1949	130	9	.59	238	77	22	200	11
1950	80	6	.57	230	46	13	204	6
1951	80	6	.60	242	48	14	225	6
1952	80	6	.62	250	50	14	229	6

Table 12. - Wool: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	480	64	.21	92	101	60		
1910	486	65	.22	96	107	63	77	82
1911	566	76	.16	70	91	54	78	69
1912	627	84	.16	70	100	59	81	73
1913	546	73	.14	61	76	45	81	56
1914	640	86	.14	61	90	53	82	65
1915	607	81	.15	66	91	54	84	64
1916	636	85	.21	92	134	79	93	85
1917	648	87	.35	154	227	134	118	114
1918	681	91	.44	193	300	178	138	129
1919	617	83	.37	162	228	135	157	86
1920	624	84	.28	123	175	104	171	61
1921	574	77	.12	53	69	41	124	33
1922	574	77	.15	66	86	51	121	42
1923	583	78	.20	88	117	69	127	54
1924	618	83	.28	123	173	102	128	80
1925	637	85	.39	171	248	147	131	112
1926	618	83	.27	118	167	99	128	77
1927	660	88	.26	114	172	102	127	80
1928	688	92	.33	145	227	134	129	104
1929	640	86	.32	140	205	121	128	95
1930	731	98	.23	101	168	99	121	82
1931	756	101	.13	57	98	58	104	56
1932	756	101	.07	31	53	31	89	35
1933	746	100	.16	70	119	70	87	80
1934	731	98	.21	92	154	91	96	95
1935	772	103	.20	88	154	91	99	92
1936	714	96	.23	101	164	97	99	98
1937	726	97	.30	132	218	129	105	123
1938	742	99	.20	88	148	88	99	89
1939	776	104	.21	92	163	96	98	98
1940	792	106	.24	105	190	112	99	113
1941	826	111	.34	149	281	166	105	158
1942	816	109	.38	167	310	183	121	151
1943	707	95	.42	184	297	176	136	129
1944	627	84	.48	211	301	178	145	123
1945	634	85	.48	211	304	180	151	119
1946	589	79	.48	211	283	167	165	101
1947	510	68	.43	189	219	129	192	67
1948	415	56	.45	197	187	110	207	53
1949	318	43	.45	197	143	84	200	42
1950	282	38	.55	241	155	91	204	45
1951	282	38	1.04	456	293	173	225	77
1952	326	44	.51	224	166	98	229	43

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Table 13. - Chickens: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars		per cent	
1924	8,253	215	.220	142	1,816	306	128	239
1925	7,808	204	.223	144	1,740	294	131	224
1926	8,508	222	.231	150	1,969	332	128	259
1927	10,512	274	.231	150	2,424	409	127	322
1928	10,058	262	.231	150	2,319	391	129	303
1929	9,979	260	.233	151	2,328	393	128	307
1930	13,975	364	.206	133	2,873	485	121	401
1931	10,179	265	.165	107	1,678	283	104	272
1932	8,526	222	.126	82	1,072	181	89	203
1933	6,070	158	.108	70	658	111	87	128
1934	2,016	53	.122	79	246	42	96	44
1935	2,116	55	.146	95	309	52	99	53
1936	2,858	75	.163	106	466	79	99	80
1937	4,936	129	.155	100	766	129	105	123
1938	2,592	68	.155	100	402	68	99	69
1939	6,678	174	.153	99	1,020	172	98	176
1940	10,084	263	.154	100	1,553	262	99	265
1941	10,434	272	.176	114	1,836	310	105	295
1942	11,594	302	.221	143	2,562	432	121	357
1943	20,317	530	.289	187	5,872	991	136	662
1944	21,188	552	.284	184	6,017	015	145	700
1945	15,732	410	.317	205	4,987	842	151	558
1946	14,691	383	.343	222	5,039	850	165	515
1947	13,464	351	.360	233	4,847	818	192	426
1948	12,586	328	.370	240	4,657	786	207	380
1949	16,237	423	.350	227	5,683	959	200	480
1950	12,515	326	.324	210	4,055	684	204	335
1951	9,364	244	.291	188	2,725	460	225	204
1952	11,271	294	.295	191	3,325	561	229	245

Table 14. - Commercial broilers: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1939-1952

(1935 - 1939 = 100)

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of — purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1939	1,100	56	17.0	103	187	39	70	40
1940	1,380	71	18.0	110	248	52	99	53
1941	1,610	83	19.5	119	314	66	105	63
1942	2,420	124	26.0	158	629	132	121	109
1943	3,234	166	31.0	189	1,003	211	136	155
1944	3,203	164	33.0	201	1,057	222	145	153
1945	3,542	182	35.0	213	1,240	260	151	172
1946	3,011	155	39.0	237	1,174	247	165	150
1947	3,234	166	41.0	250	1,326	278	192	145
1948	3,732	192	43.0	262	1,605	337	207	163
1949	5,038	259	36.0	219	1,814	381	200	190
1950	5,794	297	30.2	184	1,750	367	204	180
1951	12,620	648	31.0	189	3,912	822	225	365
1952	22,716	1,166	29.5	180	6,701	1,407	229	614

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Table 15. - Turkeys: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1929-1952

(1935-1939 = 100)

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1929	148	24	.297	155	44	38	128	30
1930	288	47	.292	153	84	72	121	60
1931	356	59	.208	109	74	63	104	61
1932	516	85	.176	92	91	78	89	88
1933	576	95	.146	76	84	72	87	83
1934	572	94	.143	75	82	70	96	73
1935	500	82	.174	91	87	74	99	75
1936	691	114	.200	105	138	118	99	119
1937	748	123	.201	105	150	128	105	122
1938	598	98	.206	108	123	105	99	106
1939	504	83	.175	94	88	75	98	77
1940	712	117	.180	94	128	109	99	110
1941	774	127	.225	118	174	148	105	141
1942	701	115	.295	154	207	177	121	146
1943	625	103	.360	188	225	192	136	141
1944	566	93	.375	196	212	181	145	125
1945	562	92	.394	206	221	189	151	125
1946	505	83	.422	221	213	182	165	110
1947	574	94	.457	239	262	224	192	117
1948	542	89	.509	266	276	235	207	114
1949	720	118	.441	231	318	271	200	136
1950	962	158	.449	235	432	369	204	181
1951	1,215	200	.467	244	567	484	225	215
1952	1,374	226	.448	234	615	525	229	229

Table 16. - Eggs: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (doz)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	10,419	102	.268	137	2,792	143	128	112
1925	10,500	103	.296	152	3,108	159	131	121
1926	12,000	118	.286	147	3,432	175	128	137
1927	11,583	114	.252	129	2,919	149	127	117
1928	13,167	129	.274	140	3,608	184	129	143
1929	12,667	124	.282	144	3,572	182	128	142
1930	11,000	108	.254	130	2,794	143	121	118
1931	9,917	97	.177	91	1,755	90	104	87
1932	7,167	70	.132	68	946	48	89	54
1933	7,583	74	.133	68	1,009	52	87	60
1934	6,667	65	.162	83	1,080	55	96	57
1935	8,333	82	.212	109	1,767	90	99	91
1936	8,333	82	.211	108	1,758	90	99	91
1937	10,250	101	.205	105	2,101	107	105	102
1938	11,083	109	.180	92	1,995	102	99	103
1939	12,917	127	.168	86	2,170	111	98	113
1940	11,917	117	.168	86	2,002	102	99	103
1941	14,083	138	.219	112	3,084	157	105	150
1942	17,917	176	.274	140	4,909	251	121	207
1943	20,667	203	.353	181	7,295	373	136	274
1944	23,083	227	.317	162	7,317	374	145	258
1945	21,250	209	.367	188	7,799	398	151	264
1946	18,500	182	.390	200	7,215	368	165	223
1947	17,500	172	.463	237	8,102	414	192	216
1948	20,333	200	.476	244	9,679	494	207	239
1949	22,333	219	.456	234	10,184	520	200	260
1950	20,750	204	.381	195	7,906	404	204	198
1951	21,333	209	.487	249	10,389	531	225	236
1952	21,833	214	.445	228	9,716	496	229	217

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Table 17. - Cotton (lint): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

Year	Quantity sold (bales)	Index of quantity sold	(1935-1939 = 100)			Index		
			Season average price	Index of prices	Income from sales	of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent	per cent	per cent
1909	253	33	66.90	135	16,953	45		
1910	246	32	70.00	142	17,195	46	77	60
1911	385	50	48.15	98	18,518	50	78	64
1912	376	49	56.90	115	21,400	57	81	70
1913	444	58	61.15	124	27,140	73	81	90
1914	449	58	38.20	77	17,169	46	82	56
1915	341	44	54.70	111	18,656	50	84	60
1916	443	58	84.10	170	37,272	100	93	108
1917	639	83	131.95	267	84,280	226	118	192
1918	588	77	142.70	289	83,867	225	138	163
1919	298	39	178.90	362	53,255	143	157	191
1920	388	50	84.00	170	32,564	87	171	51
1921	279	36	79.25	160	22,099	59	124	48
1922	343	45	112.50	228	38,618	103	121	85
1923	368	48	138.50	280	50,952	136	127	107
1924	493	64	110.25	223	54,315	145	128	113
1925	910	118	96.40	195	87,769	235	131	179
1926	829	108	62.35	126	51,714	138	128	108
1927	548	71	99.70	202	54,638	146	127	115
1928	691	90	88.85	180	61,392	164	129	127
1929	809	105	82.25	167	66,526	178	128	139
1930	715	93	46.65	94	33,333	89	121	74
1931	900	117	27.85	56	25,063	67	104	64
1932	611	80	33.70	68	20,574	55	89	62
1933	453	59	51.20	104	23,194	62	87	71
1934	485	63	62.30	126	30,195	81	96	84
1935	556	72	54.85	111	30,512	82	99	83
1936	761	99	62.20	126	47,343	127	99	128
1937	1,104	144	42.00	85	46,352	124	105	118
1938	676	88	42.75	87	28,904	77	99	78
1939	745	97	45.10	91	33,584	90	98	92
1940	456	59	48.50	98	22,093	59	99	60
1941	310	40	85.95	174	26,644	71	105	68
1942	575	75	93.80	190	53,935	144	121	119
1943	665	87	97.70	198	64,970	174	136	128
1944	589	77	103.90	210	61,197	164	145	113
1945	387	50	113.00	229	43,698	117	151	77
1946	247	32	165.80	336	40,949	110	165	67
1947	450	59	162.15	328	72,968	195	192	102
1948	591	77	156.20	316	92,314	247	207	119
1949	644	84	146.75	297	94,507	253	200	126
1950	426	55	199.00	403	84,774	227	204	111
1951	760	99	185.50	376	140,903	377	225	168
1952	750	98	190.50	386	142,875	383	229	167

Table 18. - Cotton seed: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)								
Year	Quantity sold (tons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	80	29	22.70	92	1,816	27		
1910	75	27	25.64	104	1,923	29	77	38
1911	115	42	18.03	73	2,073	31	78	40
1912	120	44	18.79	76	2,255	34	81	42
1913	150	54	18.74	76	2,811	42	81	52
1914	165	60	15.26	62	2,518	38	82	46
1915	120	44	27.26	111	3,271	49	84	58
1916	165	60	42.83	174	7,067	107	93	115
1917	248	90	60.94	248	15,113	228	118	193
1918	225	82	64.69	264	14,555	220	138	159
1919	95	34	64.48	263	6,126	93	157	59
1920	115	42	29.07	118	3,343	50	171	29
1921	90	33	27.39	112	2,465	37	124	30
1922	110	40	28.12	114	3,093	47	121	39
1923	120	44	40.35	164	4,842	73	127	57
1924	170	62	31.18	127	5,301	80	128	62
1925	340	124	30.68	125	10,431	158	131	121
1926	314	114	21.25	86	6,672	101	128	79
1927	193	70	32.77	134	6,325	96	127	76
1928	275	100	31.76	129	8,734	132	129	102
1929	300	109	29.60	120	8,880	134	128	105
1930	255	93	21.28	87	5,426	82	121	68
1931	320	116	7.67	31	2,454	37	104	36
1932	230	84	10.11	41	2,325	35	89	39
1933	180	65	12.20	50	2,196	32	87	38
1934	195	71	31.78	129	6,197	94	96	98
1935	210	76	30.35	124	6,374	96	99	97
1936	285	104	33.77	138	9,624	145	99	146
1937	380	138	18.79	76	7,140	108	105	103
1938	235	85	20.58	84	4,836	73	99	74
1939	265	96	19.24	78	5,099	77	98	78
1940	163	59	20.32	83	3,312	50	99	50
1941	115	42	47.54	194	5,467	83	105	79
1942	220	80	44.44	181	9,777	148	121	122
1943	260	94	51.60	210	13,416	203	136	149
1944	225	82	50.20	204	11,295	171	145	118
1945	134	49	49.80	203	6,673	101	151	67
1946	80	29	61.90	252	5,362	81	165	49
1947	170	62	79.80	225	13,566	205	192	108
1948	267	97	66.70	272	17,809	269	207	130
1949	240	87	42.10	172	10,104	153	200	76
1950	140	51	79.40	323	11,116	168	204	82
1951	255	93	64.10	261	14,422	218	225	97
1952	248	90	67.50	275	16,740	253	229	110

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Table 19.- Rice: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	11,193	61	.77	104	8,619	63		
1910	11,918	65	.65	88	7,747	57	77	74
1911	10,338	56	.78	105	8,064	59	78	76
1912	9,720	53	.88	129	8,554	63	81	78
1913	9,837	53	.87	118	8,558	63	81	78
1914	10,053	54	.89	120	8,947	66	82	80
1915	11,319	61	.81	109	9,168	67	84	80
1916	18,290	99	.95	128	17,376	127	93	137
1917	14,076	76	1.89	255	26,604	195	118	165
1918	16,175	88	1.73	234	27,983	205	138	149
1919	16,836	91	2.49	336	41,922	307	157	196
1920	23,158	125	1.13	153	26,169	192	171	112
1921	16,671	90	.96	130	16,004	117	124	94
1922	17,670	96	.95	128	16,786	123	121	102
1923	14,351	78	1.09	147	15,643	115	127	91
1924	13,571	73	1.32	178	17,914	131	128	102
1925	12,521	68	1.49	201	18,656	137	131	105
1926	14,552	79	1.11	150	16,153	118	128	92
1927	18,187	98	.92	124	16,732	122	127	96
1928	17,273	94	.94	127	16,237	119	129	92
1929	17,161	93	1.00	135	17,161	126	128	98
1930	17,521	95	.77	104	13,491	99	121	82
1931	14,521	79	.52	70	7,551	55	104	53
1932	14,869	81	.43	58	6,394	47	89	53
1933	14,627	79	.78	105	11,409	84	87	97
1934	15,212	82	.82	111	12,474	91	96	95
1935	15,589	84	.71	96	11,068	81	99	82
1936	19,300	105	.90	122	17,370	127	99	128
1937	18,912	102	.69	93	13,049	96	105	91
1938	18,986	103	.65	88	12,341	90	99	91
1939	19,550	106	.74	100	14,469	106	98	108
1940	16,839	91	.85	115	14,313	105	99	106
1941	18,426	100	1.33	180	24,507	179	105	170
1942	21,307	115	1.62	215	34,517	253	121	209
1943	19,692	107	1.81	245	35,643	261	136	192
1944	19,331	105	1.79	242	34,602	253	145	174
1945	20,986	114	1.83	247	38,404	281	151	186
1946	20,769	112	2.31	312	47,976	351	165	213
1947	21,544	117	2.20	297	51,662	378	192	197
1948	22,722	123	2.19	296	49,761	364	207	176
1949	21,922	119	1.97	266	43,110	316	200	158
1950	23,433	127	2.28	295	53,463	391	204	192
1951	24,429	132	2.05	278	51,667	378	225	168
1952	26,000	141	2.61	354	67,860	495	229	216

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Table 20. - Sugar cane (sugar): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (tons)	Index of quantity sold	Season average price 1/	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	4,229	84	3.83	125	16,197	106		
1910	5,046	100	3.69	120	18,620	122	77	158
1911	5,887	117	4.29	140	25,255	165	78	212
1912	2,163	43	3.73	122	8,068	53	81	65
1913	4,214	84	3.13	102	13,190	86	81	106
1914	3,199	64	3.75	122	11,996	78	82	95
1915	2,018	40	4.55	148	9,182	60	84	71
1916	4,072	81	5.29	173	21,541	141	93	152
1917	3,813	76	7.10	232	27,072	177	118	150
1918	4,170	83	7.28	237	30,358	199	138	144
1919	1,883	37	14.00	457	26,362	172	157	110
1920	2,493	50	5.76	188	14,360	94	171	55
1921	4,181	83	3.63	118	15,177	99	124	80
1922	3,778	75	5.83	190	22,026	144	121	119
1923	2,387	47	7.09	231	16,924	111	127	87
1924	1,228	24	5.58	182	6,852	45	128	35
1925	2,644	53	4.05	132	10,708	70	131	53
1926	864	17	4.92	160	4,251	28	128	22
1927	962	19	4.61	150	4,435	29	127	23
1928	1,860	37	3.86	126	7,180	47	129	36
1929	2,918	58	3.77	123	11,001	72	128	56
1930	2,559	51	3.38	110	8,649	57	121	47
1931	2,232	44	3.29	107	7,343	48	104	46
1932	2,886	57	3.06	100	8,831	58	89	65
1933	2,600	52	3.29	107	8,554	56	87	64
1934	3,019	60	2.33	76	7,034	46	96	48
1935	4,087	81	3.18	104	12,997	85	99	86
1936	4,854	97	3.71	121	18,008	118	99	119
1937	5,258	105	2.91	95	15,309	100	105	95
1938	5,859	117	2.65	86	15,526	102	99	103
1939	5,069	101	2.88	94	14,599	96	98	98
1940	2,864	57	2.72	89	7,790	51	99	52
1941	3,938	78	3.94	129	15,516	101	105	97
1942	4,752	95	4.35	142	20,671	135	121	112
1943	5,387	107	4.60	150	24,780	162	136	119
1944	4,929	98	4.98	162	24,502	160	145	110
1945	5,209	104	5.58	182	29,206	191	151	126
1946	4,484	89	6.55	214	29,396	192	165	116
1947	3,917	78	7.24	236	28,395	186	192	97
1948	5,257	105	5.88	192	30,935	202	207	98
1949	4,984	99	6.20	202	30,963	203	200	104
1950	5,312	106	7.88	257	41,859	274	204	134
1951	4,463	89	5.87	191	26,198	171	225	76
1952	5,400	108	6.85	223	36,990	242	229	106

1/ Price does not include benefit payment by the Government.

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Table 21.- Sugar cane (sirup): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (gals) ^{1/}	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars		per cent	
1909	3,596	59	.40	105	1,438	62		
1910	5,086	83	.44	116	2,238	96	77	125
1911	5,750	94	.44	116	2,530	109	78	140
1912	6,490	106	.41	108	2,661	114	81	141
1913	6,381	104	.43	113	2,744	118	81	146
1914	5,369	87	.43	113	2,309	99	82	121
1915	5,695	93	.48	126	2,734	117	84	139
1916	6,819	111	.55	145	3,750	161	93	173
1917	8,708	142	.59	155	5,138	221	118	187
1918	13,644	222	.68	179	9,278	398	138	288
1919	3,474	57	1.07	282	3,717	160	157	102
1920	3,681	60	.96	253	3,534	152	171	89
1921	5,117	83	.54	142	2,763	119	124	96
1922	5,172	84	.49	129	2,534	109	121	90
1923	5,543	90	.59	155	3,270	140	127	110
1924	9,762	159	.43	113	4,198	180	128	141
1925	6,338	103	.35	92	2,218	95	131	73
1926	4,231	69	.41	108	1,735	74	128	58
1927	4,373	71	.44	116	1,924	83	127	65
1928	6,183	101	.37	97	2,288	98	129	76
1929	5,172	84	.41	108	2,121	91	128	71
1930	5,757	94	.36	95	2,073	89	121	74
1931	3,845	63	.39	103	1,500	64	104	62
1932	2,974	48	.34	89	1,011	43	89	48
1933	4,618	75	.33	87	1,524	65	87	75
1934	6,054	99	.37	97	2,240	96	96	100
1935	5,557	91	.40	105	2,223	95	99	96
1936	6,133	100	.36	95	2,208	95	99	96
1937	6,263	102	.41	108	2,568	110	105	105
1938	5,817	95	.38	100	2,210	95	99	96
1939	6,914	113	.35	92	2,420	104	98	106
1940	4,551	74	.40	105	1,820	78	99	79
1941	4,866	79	.56	147	2,725	117	105	111
1942	4,760	78	.62	163	2,951	127	121	105
1943	6,699	109	.74	195	4,957	213	136	157
1944	5,536	90	.66	174	3,654	157	145	108
1945	13,275	216	.74	195	9,824	422	151	279
1946	10,643	173	1.20	316	12,772	548	165	332
1947	7,614	124	.80	211	6,091	261	192	136
1948	1,532	25	.80	211	1,226	53	207	26
1949	2,199	36	.70	184	1,539	66	200	33
1950	3,672	60	.80	210	2,938	126	204	62
1951	1,727	28	.85	224	1,468	63	225	28
1952	2,100	34	.94	247	1,974	85	229	37

^{1/} Total given as toll and sold

Table 22. - Sorghum (sirup): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1939-1952

(1935-1939 = 100)

Year	Quantity sold (gals.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1939	20	13	.41	77	8	9	98	9
1940	35	23	.39	74	14	16	98	16
1941	21	14	.50	94	10	12	105	11
1942	658	424	.55	104	362	423	121	350
1943	42	27	.80	151	34	40	136	29
1944	38	24	.85	160	32	37	145	26
1945	36	23	.90	170	32	37	151	25
1946	24	15	1.35	255	32	37	165	22
1947	21	14	1.40	264	29	34	192	18
1948	26	17	.95	179	25	29	207	14
1949	27	17	1.00	189	27	32	200	16
1950	33	21	.95	179	31	36	204	18
1951							225	
1952							229	

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Table 23.- Corn: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)								
Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	2,341	135	.74	106	1,732	152		
1910	3,900	225	.62	89	2,418	212	77	275
1911	2,000	115	.76	109	1,520	133	78	171
1912	735	42	.73	105	537	47	81	58
1913	2,140	123	.82	117	1,755	154	81	190
1914	2,460	142	.87	127	2,140	188	82	229
1915	2,085	120	.72	103	1,501	132	84	157
1916	1,813	104	1.13	162	2,049	180	93	194
1917	1,462	84	1.62	232	2,368	208	118	176
1918	1,020	59	1.72	246	1,754	154	138	112
1919	655	38	1.73	248	1,133	99	157	63
1920	1,040	60	.99	142	1,030	90	171	53
1921	955	55	.72	103	688	60	124	48
1922	850	49	.94	135	799	70	121	58
1923	1,022	59	1.09	156	1,114	98	127	77
1924	657	38	1.22	175	802	70	128	55
1925	966	56	1.01	145	976	86	131	66
1926	858	49	.90	129	772	68	128	53
1927	912	53	.99	142	903	79	127	62
1928	910	52	.98	140	892	78	129	60
1929	924	53	.95	136	878	77	128	60
1930	634	37	.89	128	564	50	121	41
1931	1,284	74	.44	63	565	50	104	48
1932	1,051	61	.44	63	462	41	89	46
1933	915	53	.63	90	576	51	87	59
1934	743	43	.91	130	676	59	96	61
1935	1,932	111	.71	102	1,372	120	99	121
1936	926	53	.96	138	889	78	99	79
1937	1,929	111	.66	95	1,273	112	105	107
1938	2,760	159	.52	74	1,435	126	99	127
1939	1,133	65	.64	92	725	64	98	65
1940	1,476	85	.65	93	959	84	99	85
1941	1,281	74	.83	119	1,063	93	105	89
1942	1,511	87	.99	142	1,496	131	121	108
1943	1,093	63	1.35	193	1,476	130	136	96
1944	877	51	1.39	199	1,219	107	145	74
1945	1,273	73	1.39	199	1,769	155	151	103
1946	887	108	1.79	256	1,588	139	165	84
1947	762	44	2.20	315	1,676	147	192	76
1948	990	57	1.58	226	1,564	137	207	66
1949	992	57	1.30	186	1,290	113	200	56
1950	1,076	62	1.46	209	1,571	138	204	68
1951	1,012	58	1.65	236	1,720	151	225	67
1952	762	44	1.90	272	1,448	127	229	55

Table 24.- Oats: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	26	15	.65	141	17	22		
1910	29	16	.56	121	16	20	77	26
1911	29	16	.62	134	18	23	78	29
1912	28	16	.59	128	17	22	81	27
1913	43	24	.56	121	24	30	81	37
1914	74	42	.62	134	46	58	82	71
1915	189	107	.64	139	121	153	84	182
1916	124	70	.61	132	76	96	93	103
1917	79	45	.90	195	71	90	118	76
1918	66	37	1.05	227	69	87	138	63
1919	40	23	1.05	227	42	53	157	34
1920	40	23	1.09	236	44	56	171	35
1921	37	21	.62	134	23	29	124	33
1922	34	19	.61	132	21	27	121	22
1923	24	14	.66	143	16	20	127	16
1924	16	9	.70	152	11	14	128	11
1925	18	10	.69	149	12	15	131	11
1926	20	11	.61	132	12	15	128	12
1927	9	5	.64	139	6	8	127	6
1928	12	7	.72	156	9	11	129	9
1929	11	6	.68	147	7	9	128	7
1930	17	10	.51	123	10	13	121	11
1931	54	30	.37	80	20	25	104	24
1932	12	7	.30	65	4	5	89	6
1933	11	6	.45	97	5	6	87	7
1934	54	30	.62	134	33	42	96	44
1935	128	72	.49	106	63	80	99	81
1936	103	58	.54	117	56	71	99	72
1937	172	97	.51	110	88	111	105	106
1938	215	121	.37	80	80	101	99	102
1939	269	152	.40	87	108	137	98	140
1940	279	157	.42	91	117	148	99	149
1941	507	286	.47	102	238	301	105	287
1942	609	343	.58	126	353	447	121	369
1943	628	354	.88	190	553	700	136	515
1944	793	447	.98	212	777	984	145	679
1945	880	496	.85	184	748	947	151	627
1946	374	211	1.16	251	434	549	165	33
1947	520	293	1.14	247	592	751	192	391
1948	504	284	1.06	229	534	676	207	326
1949	315	178	.90	195	284	359	200	180
1950	155	87	.99	214	153	194	204	95
1951	169	95	1.08	234	183	232	225	103
1952	210	118	1.08	234	227	491	229	214

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Table 25. - All hay: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)								
Year	Quantity sold (tons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	41	134	11.00	109	451	146		
1910	42	137	11.20	111	470	152	77	197
1911	41	134	12.70	126	521	168	78	215
1912	32	105	12.50	124	400	129	81	159
1913	33	108	12.50	124	412	133	81	164
1914	33	108	12.20	121	403	130	82	159
1915	30	98	12.00	119	360	116	84	138
1916	26	85	11.90	118	309	100	93	108
1917	20	65	16.30	162	336	109	118	92
1918	16	52	21.00	209	336	109	138	79
1919	25	82	22.60	225	565	182	157	116
1920	23	75	18.20	181	419	135	171	79
1921	27	88	13.20	131	356	115	124	93
1922	34	111	13.80	137	469	151	121	125
1923	37	121	14.60	145	540	174	127	137
1924	19	62	18.00	179	342	110	128	86
1925	9	29	17.60	175	158	51	131	39
1926	33	108	15.70	156	518	167	128	130
1927	24	78	13.60	135	326	105	127	83
1928	39	127	13.20	131	515	166	129	129
1929	28	92	12.80	127	358	116	128	91
1930	19	62	12.00	119	228	74	121	61
1931	30	98	8.60	85	258	83	104	80
1932	32	105	7.30	73	234	76	89	85
1933	29	95	7.70	77	223	72	87	83
1934	29	95	9.60	95	278	90	96	94
1935	29	95	9.40	93	273	88	99	89
1936	29	95	10.30	102	309	97	99	98
1937	31	101	10.00	99	310	100	105	95
1938	29	95	9.20	91	267	86	99	87
1939	35	114	11.40	113	309	129	98	132
1940	37	121	10.80	107	400	129	99	130
1941	42	137	11.20	111	470	152	105	145
1942	42	137	13.10	130	550	178	121	147
1943	42	137	22.20	221	932	301	136	221
1944	43	141	21.70	216	933	301	145	208
1945	47	154	21.40	213	1,006	375	151	215
1946	50	163	23.40	233	1,170	378	165	229
1947	39	127	24.90	248	971	314	192	164
1948	33	108	26.40	262	871	281	207	136
1949	40	131	22.50	224	900	291	200	146
1950	47	154	24.40	243	1,147	370	204	181
1951	34	111	28.50	285	969	313	225	139
1952	50	163	30.50	303	1,525	492	229	215

Table 26. - Soybeans: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)

Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars		per cent	
1924	42	51	3.33	206	140	102	128	80
1925	88	107	3.57	221	314	229	131	175
1926	116	141	2.86	177	332	242	128	189
1927	146	178	2.78	172	406	295	127	232
1928	89	109	2.99	185	266	194	129	150
1929	148	180	3.16	195	468	341	128	266
1930	94	115	2.73	169	257	187	121	155
1931	70	85	1.78	110	125	91	104	87
1932	50	61	1.34	83	67	49	89	55
1933	31	38	2.01	124	62	45	87	52
1934	33	40	2.54	157	84	61	96	64
1935	27	33	1.99	123	54	39	99	39
1936	165	201	2.15	133	355	258	99	261
1937	46	56	1.41	87	65	47	105	45
1938	59	72	1.36	84	80	58	99	59
1939	113	138	1.18	73	133	97	98	99
1940	59	72	1.40	90	86	63	99	64
1941	87	106	1.97	122	171	124	105	118
1942	617	752	1.89	117	1,166	849	121	702
1943	208	254	2.80	173	582	424	136	312
1944	227	277	2.83	175	642	467	145	322
1945	244	298	2.65	164	647	471	151	312
1946	249	304	3.01	186	749	545	165	330
1947	224	273	3.33	206	746	543	192	283
1948	384	468	2.64	163	1,014	738	207	356
1949	308	376	2.31	143	711	517	200	258
1950	616	751	2.35	145	1,448	1,054	204	517
1951	530	646	2.65	164	1,404	1,022	225	454
1952	490	598	2.75	170	1,348	981	229	428

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Table 27. - Cowpeas: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)								
Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	81	244	3.75	229	304	563	128	440
1925	131	395	3.55	216	465	861	131	657
1926	37	111	2.70	165	100	185	128	145
1927	70	211	2.41	147	169	313	127	246
1928	48	145	2.69	164	129	239	129	185
1929	22	66	2.82	172	62	115	128	90
1930	9	27	2.42	148	22	41	121	34
1931	16	48	1.35	82	22	41	104	39
1932	49	148	1.14	70	56	104	89	117
1933	26	78	1.61	98	42	78	87	90
1934	49	148	1.95	119	96	178	96	185
1935	51	154	1.76	107	90	167	99	169
1936	21	63	1.98	121	42	78	99	79
1937	25	75	1.64	100	41	76	105	72
1938	30	90	1.47	90	44	81	99	82
1939	39	117	1.35	82	53	98	98	100
1940	62	187	1.47	90	91	169	99	171
1941	67	202	2.03	124	136	252	105	240
1942	45	136	2.46	150	111	206	121	170
1943	51	154	3.28	200	167	309	136	227
1944	71	214	3.34	204	237	439	145	303
1945	37	111	3.45	210	128	237	151	157
1946	23	69	4.30	262	99	183	165	111
1947	48	144	4.77	291	229	424	192	221
1948	29	87	4.31	263	125	231	207	112
1949	43	130	3.54	216	152	281	200	140
1950	31	93	4.33	264	134	248	204	122
1951	18	54	4.67	285	81	150	225	67
1952	24	72	4.50	274	108	200	229	87

Table 28. - Peanuts: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

Year	Quantity sold (lbs)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
						per cent		
	1,000	per cent	cents	per cent	1,000 dollars			
1909	690	170	3.4	70	29	111		
1910	340	84	3.6	71	12	58	77	75
1911	981	241	4.1	81	40	192	78	246
1912	520	128	3.5	69	18	87	81	107
1913	605	149	4.1	81	25	120	81	148
1914	1,120	276	4.3	85	52	250	82	305
1915	1,812	446	4.9	96	89	428	84	510
1916	1,716	422	4.8	94	82	394	93	424
1917	2,686	661	6.3	124	169	812	118	688
1918	1,664	409	6.8	134	113	543	138	393
1919	1,318	324	9.6	189	127	611	157	389
1920	1,956	481	6.5	128	127	611	171	357
1921	2,012	495	6.4	126	129	620	124	500
1922	2,012	495	6.4	126	125	620	121	512
1923	1,380	339	7.3	144	101	486	127	383
1924	313	77	6.3	124	20	96	128	75
1925	733	180	6.1	120	45	216	131	165
1926	684	168	6.8	134	47	226	128	177
1927	2,448	602	7.4	146	181	870	127	685
1928	849	209	7.2	142	61	293	129	227
1929	1,948	479	6.7	132	131	630	128	492
1930	395	97	6.4	126	25	120	121	99
1931	1,598	389	4.2	83	66	317	104	305
1932	516	127	3.8	75	20	96	89	108
1933	1,632	401	4.4	87	72	346	87	398
1934	255	63	4.7	93	12	58	96	60
1935	278	68	4.9	96	14	67	99	68
1936	180	44	5.2	102	9	43	99	43
1937	423	104	5.1	100	22	106	105	101
1938	746	182	4.9	96	37	178	99	180
1939	406	100	5.3	104	22	106	98	108
1940	963	237	5.0	98	48	231	99	233
1941	469	115	5.7	112	27	130	105	124
1942	4,662	1,147	5.1	100	238	1,144	121	945
1943	4,261	1,048	7.3	144	311	1,495	136	1,099
1944	191	47	8.4	165	16	77	145	53
1945	826	203	9.0	177	74	356	151	236
1946	108	26	10.8	213	12	58	165	35
1947	238	58	12.9	254	31	149	192	78
1948	279	69	14.0	276	39	187	207	90
1949	396	97	13.4	264	53	255	200	128
1950	439	108	15.0	295	66	317	204	155
1951	426	105	14.6	287	62	298	225	132
1952	350	86	16.0	315	56	269	229	117

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Table 29. - Irish potatoes: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	percent	dollars	per cent	1,000 dollars		percent	
1909	1,022	55	1.02	129	1,042	70		
1910	936	50	.78	99	730	49	77	64
1911	1,148	62	.85	108	976	66	78	87
1912	836	45	1.10	139	920	62	81	77
1913	921	50	.98	124	903	61	81	75
1914	963	52	.97	123	934	63	82	77
1915	770	41	1.05	133	808	55	84	65
1916	1,055	57	1.14	144	1,203	81	93	87
1917	1,202	65	2.59	328	3,113	210	118	178
1918	2,240	120	1.02	129	2,285	154	138	112
1919	778	42	1.81	229	1,408	95	157	61
1920	891	48	2.19	277	1,951	132	171	77
1921	1,071	58	1.63	206	1,746	118	124	95
1922	991	53	1.35	171	1,338	90	121	74
1923	1,090	59	1.45	184	1,580	107	127	84
1924	1,112	60	1.26	159	1,401	95	128	74
1925	1,092	59	1.33	168	1,452	98	131	75
1926	1,232	66	2.00	253	2,464	167	128	130
1927	1,197	64	1.69	214	2,023	137	127	108
1928	1,665	90	1.00	127	1,665	113	129	88
1929	961	52	1.50	190	1,442	97	128	76
1930	1,477	79	1.35	171	1,994	135	121	112
1931	2,385	128	.50	63	1,192	81	104	78
1932	1,166	63	.69	87	805	54	89	61
1933	1,343	72	.73	92	980	66	87	76
1934	1,768	95	.51	65	902	61	96	64
1935	1,624	87	.70	89	1,137	77	99	78
1936	2,031	109	1.25	158	2,539	172	99	174
1937	2,000	108	.65	82	1,300	88	105	84
1938	2,070	111	.60	76	1,242	84	99	85
1939	1,571	84	.75	95	1,178	80	98	82
1940	1,703	92	.81	103	1,379	93	99	94
1941	1,975	106	.61	77	1,205	81	105	77
1942	1,849	99	1.11	141	2,052	139	121	115
1943	3,070	165	1.57	199	4,820	326	136	240
1944	2,624	141	1.22	154	3,201	216	145	149
1945	1,838	99	1.93	244	3,547	240	151	159
1946	1,604	86	1.37	173	2,197	149	165	90
1947	1,119	60	1.60	203	1,790	121	192	63
1948	918	49	1.91	242	1,753	119	207	57
1949	756	41	1.91	242	1,444	98	200	49
1950	436	23	1.57	199	685	46	204	23
1951	385	21	1.67	211	643	43	225	19
1952	365	20	2.70	342	986	67	229	29

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Table 30. - Sweet potatoes: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

Year	Quantity sold (bu)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	1,354	39	.67	98	907	38		
1910	1,355	39	.69	101	935	49	77	52
1911	1,470	42	.72	106	1,058	45	78	58
1912	1,456	42	.75	110	1,092	46	81	57
1913	1,657	48	.71	104	1,176	50	81	62
1914	1,523	44	.67	98	1,020	43	82	52
1915	1,682	48	.58	85	976	41	84	49
1916	1,805	52	.73	107	1,318	56	93	50
1917	1,720	50	1.12	164	1,926	82	118	69
1918	1,607	46	1.47	216	2,362	100	138	72
1919	1,949	56	1.62	238	3,157	134	157	85
1920	2,444	70	1.16	170	2,835	120	171	70
1921	2,388	69	.84	123	2,006	85	124	69
1922	2,239	64	.89	130	1,993	85	121	70
1923	1,811	52	1.24	182	2,246	95	127	75
1924	1,013	29	1.71	251	1,732	73	128	57
1925	2,009	58	1.62	238	3,255	138	131	105
1926	2,081	60	1.06	155	2,206	94	128	73
1927	2,802	81	.99	145	2,774	118	127	93
1928	1,923	55	1.01	148	1,942	82	129	64
1929	2,115	61	1.16	170	2,453	104	128	81
1930	1,747	50	1.11	163	1,935	82	121	68
1931	2,578	74	.60	88	1,547	66	104	63
1932	3,052	88	.46	67	1,404	60	89	67
1933	2,554	75	.65	95	1,686	72	87	83
1934	3,142	90	.74	109	2,325	99	96	103
1935	3,817	110	.58	85	2,214	94	99	95
1936	3,328	96	.87	128	2,895	123	99	124
1937	3,311	95	.69	101	2,285	97	105	92
1938	3,567	103	.64	94	2,283	97	99	98
1939	3,347	96	.63	92	2,109	89	98	91
1940	2,188	63	.76	111	1,663	71	99	72
1941	3,930	113	.72	106	2,830	120	105	114
1942	4,121	119	1.00	147	4,121	175	121	145
1943	5,287	152	1.81	265	9,569	406	136	299
1944	6,135	176	1.45	213	8,896	377	145	260
1945	8,008	230	1.46	214	11,692	496	151	328
1946	7,240	208	1.57	230	11,367	482	165	292
1947	4,974	143	1.52	223	7,560	321	192	167
1948	5,158	148	1.60	235	8,253	350	207	169
1949	5,438	156	1.69	248	9,190	390	200	195
1950	6,847	197	.98	144	6,710	285	204	140
1951	4,612	133	2.84	416	13,144	558	225	250
1952	5,010	144	2.85	418	14,278	606	229	265

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Table 31. - Tobacco (Perique): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1919-1952

(1935-1939 = 100)

Year	Quantity sold (lbs.)	Index of quantity sold	Season averag price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	cents	per cent	1,000 dollars	per cent		
1919	348	181	65.00	250	226	419	157	269
1920	380	198	40.00	154	152	281	171	164
1921	418	218	55.00	212	230	426	124	344
1922	478	249	55.00	212	263	487	121	402
1923	396	206	50.00	192	198	367	127	289
1924	320	167	55.00	212	176	326	128	255
1925	360	187	55.00	212	198	367	131	280
1926	40	21	45.00	173	18	33	128	26
1927	42	22	45.00	173	19	35	127	28
1928	81	42	45.00	173	36	67	129	52
1929	120	62	40.00	154	48	89	128	70
1930	267	139	30.00	115	80	148	121	122
1931	246	128	26.00	100	64	119	104	114
1932	172	90	27.50	106	47	87	89	98
1933	128	67	23.00	88	29	54	87	62
1934	35	18	20.00	77	7	13	96	14
1935	42	22	18.00	69	8	15	99	15
1936	48	25	25.00	96	12	22	99	22
1937	200	104	30.00	115	60	111	105	106
1938	300	156	30.00	115	90	167	99	169
1939	370	193	27.00	104	100	185	98	189
1940	138	72	25.00	96	34	63	99	64
1941	57	30	17.00	65	10	19	105	18
1942	70	36	30.00	115	21	39	121	32
1943	150	78	40.00	154	60	111	136	82
1944	210	109	42.50	163	89	165	145	114
1945	192	100	65.00	250	125	231	151	153
1946	150	78	80.00	308	120	222	165	135
1947	249	130	60.00	231	149	276	192	144
1948	240	125	60.00	231	144	267	207	129
1949	200	104	60.00	231	120	222	200	111
1950	150	78	60.00	231	90	167	204	82
1951	264	137	60.00	231	158	293	225	130
1952	180	94	60.00	231	108	200	229	87

Table 32.-Tung nuts: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1939-1952

(1935-1939 = 100)

Year	Quantity sold (tons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1939	.15	1.5	39.00	48.4	6	.8	98	.8
1940	1.20	12.2	55.00	68.3	66	8.8	99	8.8
1941	1.80	18.2	91.00	113.0	164	22.0	105	20.9
1942	4.00	40.6	87.00	108.0	348	46.7	121	38.5
1943	3.26	33.1	100.00	124.2	326	43.8	136	32.2
1944	7.55	76.6	103.00	127.9	778	104.5	145	72.0
1945	10.75	109.1	101.00	125.4	1,086	145.9	151	96.6
1946	15.20	154.3	90.00	111.8	1,368	183.8	165	111.3
1947	15.50	157.4	64.00	79.5	992	133.3	192	69.4
1948	14.00	142.1	50.00	62.1	700	94.0	207	45.4
1949	25.20	255.9	64.00	79.5	1,613	216.7	200	108.3
1950	6.10	61.9	94.00	116.7	573	77.0	204	37.7
1951	2.90	29.4	97.00	120.4	281	37.7	225	16.7
1952	32.00	325.0	85.00	105.5	2,720	365.5	229	159.6

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Table 33. - Strawberries: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1918-1952

Year	Quantity sold (24-pt. crates)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of	of prices	of
						income	paid by farmers	purchasing power
	1,000	percent	dollars	percent	1,000 dollars	percent		
1918	608	26	2,875	173	1,748	45	138	33
1919	678	29	3,125	188	2,119	55	157	35
1920	910	39	3,350	201	3,048	79	171	46
1921	1,402	60	3,250	195	4,556	118	124	95
1922	1,758	75	2,150	129	3,780	98	121	81
1923	1,550	66	3,000	180	4,650	120	127	94
1924	1,490	64	3,250	195	4,842	125	128	98
1925	868	37	3,000	180	2,604	67	131	51
1926	2,072	89	3,340	200	6,920	179	128	140
1927	1,392	60	2,610	157	3,633	94	127	74
1928	2,692	115	3,010	181	8,103	210	129	163
1929	2,496	107	2,210	133	5,516	143	128	112
1930	1,936	83	2,560	154	4,956	128	121	106
1931	3,690	158	2,060	124	7,601	197	104	189
1932	3,082	132	1,210	73	3,729	97	89	109
1933	2,556	110	1,305	78	3,336	86	87	99
1934	2,484	107	1,385	83	3,440	89	96	93
1935	1,542	66	1,685	101	2,598	67	99	68
1936	2,486	107	1,740	104	4,326	112	99	113
1937	2,886	124	1,530	92	4,416	114	105	109
1938	2,002	86	1,750	105	3,504	91	99	92
1939	2,744	118	1,625	98	4,459	116	98	118
1940	2,028	87	1,810	109	3,671	95	99	96
1941	2,454	105	1,425	86	3,497	91	105	87
1942	3,024	130	2,050	123	6,199	161	121	133
1943	1,200	51	3,625	218	4,350	113	136	83
1944	990	42	4,925	296	4,876	126	145	87
1945	1,524	65	5,050	303	7,696	199	151	132
1946	2,150	92	5,200	312	11,180	290	165	176
1947	1,680	72	4,500	270	7,560	196	192	102
1948	1,634	70	5,135	308	8,391	217	207	105
1949	1,134	49	5,270	316	5,976	155	200	78
1950	1,364	58	4,800	288	6,554	170	204	83
1951	603	26	875	525	4,574	118	225	52
1952	377	16	1,087	652	4,098	106	229	46

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Table 34. - Oranges: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1919-1952

(1935-1939 = 100)								
Year	Quantity sold (boxes)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1919	25	10	2.79	208	70	21	157	13
1920	29	11	1.74	130	50	15	171	9
1921	37	14	2.39	178	88	26	124	21
1922	46	18	2.29	171	105	31	121	26
1923	61	24	0.84	63	51	15	127	12
1924	60	23	1.72	128	103	30	128	23
1925	84	33	2.23	166	187	55	131	42
1926	133	52	2.11	157	281	83	128	65
1927	181	71	3.51	262	635	188	127	148
1928	200	78	2.50	186	500	148	129	115
1929	169	66	2.86	213	483	143	128	112
1930	265	104	1.53	114	405	120	121	99
1931	223	87	1.33	99	297	88	104	85
1932	256	100	1.28	95	328	97	89	109
1933	221	87	1.44	107	318	94	87	108
1934	269	105	1.06	79	285	84	96	88
1935	219	86	1.62	121	355	105	99	106
1936	284	111	1.62	121	460	136	99	132
1937	213	83	1.37	102	292	86	105	82
1938	355	139	1.00	75	355	105	99	106
1939	206	81	1.10	82	227	67	98	68
1940	233	91	1.00	75	233	69	99	70
1941	179	70	1.20	89	215	64	105	61
1942	324	127	2.25	168	729	216	121	179
1943	226	88	3.40	253	768	227	136	167
1944	346	135	2.60	194	900	266	145	183
1945	316	124	2.55	190	806	239	151	158
1946	394	154	1.90	142	749	222	165	135
1947	284	111	1.75	130	497	147	192	77
1948	284	111	1.85	138	525	155	207	75
1949	354	139	2.20	164	779	231	200	116
1950	285	112	2.15	160	613	181	204	89
1951	45	18	3.80	283	171	51	225	23
1952	57	22	4.30	320	245	72	229	31

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Table 35.- Peaches: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
						per cent		
	1,000	per cent	dollars	per cent	1,000 dollars			
1909	131	86	.78	72	102	62		
1910	298	196	1.00	92	298	181	77	235
1911	65	43	1.00	92	65	40	78	51
1912	473	311	.80	73	378	230	81	284
1913	251	165	1.50	138	376	229	81	283
1914	148	97	1.00	92	148	90	82	110
1915	206	136	.95	87	196	119	84	142
1916	260	171	.85	80	221	134	93	144
1917	187	123	1.25	115	234	142	118	120
1918	233	153	1.40	128	326	198	138	143
1919	201	132	1.80	165	362	220	157	140
1920	117	77	2.70	248	316	192	171	112
1921	94	62	1.45	133	136	83	124	67
1922	41	27	1.45	133	59	36	121	30
1923	28	18	1.90	174	53	32	127	25
1924	68	45	1.85	170	126	77	128	60
1925	98	64	1.75	161	172	105	131	80
1926	74	49	1.50	138	111	68	128	53
1927	10	7	1.80	165	18	11	127	9
1928	82	54	1.60	148	131	80	129	62
1929	65	43	1.70	156	110	67	128	52
1930	45	30	1.75	161	79	48	121	40
1931	203	134	1.05	96	213	130	104	125
1932	31	20	1.05	96	33	20	89	22
1933	97	64	1.10	101	107	65	87	75
1934	179	118	.75	69	134	82	96	85
1935	151	99	1.05	96	159	97	99	98
1936	202	133	1.10	101	222	135	99	136
1937	106	70	1.25	115	132	80	105	76
1938	132	89	1.00	92	132	80	99	81
1939	169	111	1.05	96	177	108	98	110
1940	189	124	1.00	92	189	115	99	116
1941	176	116	1.05	96	185	113	105	108
1942	161	106	1.30	119	209	127	121	105
1943	84	55	3.10	284	261	156	136	116
1944	135	89	3.00	275	405	246	145	170
1945	185	122	2.95	271	546	337	151	220
1946	133	87	3.05	280	406	247	165	150
1947	96	63	2.85	261	274	167	192	87
1948	99	65	2.90	266	287	175	207	85
1949	48	32	2.80	257	134	82	200	41
1950	26	17	3.40	312	88	54	204	26
1951	35	23	3.40	312	119	72	225	32
1952	37	24	3.30	303	122	74	229	32

Table 36. - Pears: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1909-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1909	14	13						
1910	11	11					77	
1911	6	6					78	
1912	30	29					81	
1913	24	23					81	
1914	30	29					82	
1915	33	32					84	
1916	30	29					93	
1917	26	25					118	
1918	34	33					138	
1919	35	34	1.25	189	44	66	157	42
1920	24	23	1.75	265	42	63	171	37
1921	23	22	2.29	347	53	80	124	65
1922	36	35	1.71	259	62	94	121	78
1923	20	19	1.70	258	34	51	127	40
1924	37	26	1.90	288	70	106	128	83
1925	42	40	1.45	220	61	92	131	70
1926	41	39	1.30	197	53	80	128	63
1927	30	29	1.40	212	42	63	127	50
1928	46	44	1.35	205	62	94	129	73
1929	43	41	1.35	205	58	88	128	69
1930	54	52	1.30	197	70	106	121	88
1931	87	84	.90	136	78	118	104	113
1932	60	58	.70	106	42	63	89	71
1933	45	43	1.00	152	45	68	87	78
1934	119	114	.55	83	65	98	96	102
1935	79	76	.75	114	59	89	99	90
1936	144	138	.65	98	94	142	99	143
1937	51	49	.70	106	36	54	105	51
1938	149	143	.50	76	74	112	99	113
1939	97	93	.70	106	68	103	98	105
1940	185	178	.50	76	92	139	99	140
1941	120	115	.60	91	72	109	105	104
1942	174	167	.65	98	113	171	121	141
1943	51	49	1.70	258	87	131	136	96
1944	183	176	1.25	189	229	346	145	239
1945	143	137	1.30	197	186	281	151	186
1946	130	125	1.50	227	195	294	165	178
1947	101	97	1.45	220	146	220	192	114
1948	95	91	1.25	189	119	180	207	87
1949	60	58	1.30	197	78	118	200	59
1950	45	43	1.30	197	58	88	204	43
1951	22	21	1.55	235	34	51	225	23
1952	47	45	1.50	227	70	106	229	46

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Table 37. - Pecans (all): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1919-1952

(1935-1939 = 100)								
Year	Quantity sold (lbs.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	cents	per cent	1,000 dollars	per cent		
1919	4,000	55	29.0	301	1,160	170	157	108
1920	352	5	31.0	322	109	16	171	9
1921	4,600	63	21.0	217	966	142	124	115
1922	264	4	21.7	225	57	8	121	7
1923	3,350	46	18.7	194	626	92	127	72
1924	905	12	26.3	273	238	35	128	27
1925	4,530	62	19.8	205	897	131	131	100
1926	5,000	69	17.3	179	865	127	128	99
1927	1,378	19	20.3	211	280	41	127	32
1928	4,500	62	13.9	144	626	92	129	71
1929	1,860	26	18.2	189	339	50	128	39
1930	6,973	96	14.4	149	1,004	147	121	121
1931	7,192	99	9.4	98	676	99	104	95
1932	5,264	72	8.3	86	437	64	89	72
1933	9,475	130	7.0	73	663	97	87	111
1934	3,372	46	12.4	129	416	61	96	64
1935	7,892	109	8.7	90	687	101	99	102
1936	6,276	86	12.2	127	766	112	99	113
1937	9,988	137	8.2	85	807	118	105	112
1938	5,788	80	9.5	98	545	80	99	81
1939	6,376	88	9.6	100	606	89	98	91
1940	7,784	107	9.7	101	752	110	99	111
1941	4,800	66	10.0	104	475	70	105	67
1942	5,600	77	75.4	160	857	126	121	104
1943	11,000	151	20.2	210	2,203	323	136	237
1944	13,250	182	18.6	193	2,462	361	145	249
1945	8,580	118	21.1	219	1,808	265	151	175
1946	8,430	116	30.7	318	2,586	379	165	230
1947	4,650	64	24.6	255	1,143	168	192	87
1948	18,000	248	12.3	128	2,216	325	207	157
1949	16,000	220	17.1	177	2,740	402	200	201
1950	8,200	113	26.4	274	2,162	317	204	155
1951	14,700	202	19.3	200	2,832	415	225	184
1952	12,400	171	20.4	212	2,530	371	229	162

Table 38. - Pecans (improved and seedling or wild): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1937-1952

(1935-1939 = 100)								
Year	Quantity sold (lbs.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	cents	per cent	1,000 dollars	per cent		
Pecans: improved								
1937	2,876	140	12.00	89	345	127	105	121
1938	1,790	87	13.00	96	233	86	99	87
1939	1,853	90	13.90	103	258	95	98	97
1940	2,674	130	13.20	97	353	130	99	131
1941	1,100	53	15.60	115	172	63	105	60
1942	1,600	78	19.80	146	317	116	121	96
1943	2,240	109	26.00	192	582	214	136	157
1944	3,314	161	25.70	190	852	313	145	216
1945	1,480	72	26.20	194	388	143	151	95
1946	1,880	91	35.10	259	660	242	165	147
1947	1,150	56	35.50	264	408	150	192	78
1948	4,350	211	18.00	133	783	288	207	139
1949	3,600	175	21.00	155	756	278	200	139
1950	1,600	78	32.00	236	512	188	204	92
1951	3,100	151	24.00	177	744	273	225	121
1952	2,976	144	28.00	207	833	306	229	134
Pecans: seedling or wild								
1937	7,112	145	6.50	86	462	127	105	121
1938	3,998	82	7.80	103	312	86	99	87
1939	4,523	93	7.70	101	348	95	98	97
1940	5,110	105	7.80	103	399	109	99	110
1941	3,700	76	8.20	108	303	83	105	79
1942	4,000	82	13.50	178	540	148	121	122
1943	8,760	179	18.50	243	1,621	444	136	326
1944	9,936	203	16.20	213	1,610	441	145	304
1945	7,100	145	20.00	263	1,420	389	151	258
1946	6,550	134	29.40	387	1,926	528	165	320
1947	3,500	72	21.00	276	735	201	192	105
1948	13,650	279	10.50	138	1,433	393	207	190
1949	12,400	254	16.00	211	1,984	544	200	272
1950	6,600	135	25.00	329	1,650	452	204	222
1951	11,600	237	18.00	237	2,088	572	225	254
1952	9,424	193	18.00	237	1,696	465	229	203

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Table 39. - Snap beans (mid-spring market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1918-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1918	133	24	2.25	241	299	58	138	42
1919	128	23	2.35	252	301	58	157	37
1920	84	15	2.25	241	189	36	171	21
1921	160	28	2.75	295	440	85	124	69
1922	114	20	1.60	172	182	35	121	29
1923	108	19	2.55	274	275	53	127	42
1924	282	50	1.80	193	508	98	128	77
1925	370	65	1.35	145	500	96	131	73
1926	308	54	2.15	231	662	128	128	100
1927	341	60	1.35	145	460	89	127	70
1928	407	72	1.55	166	631	122	129	95
1929	640	113	1.35	145	864	166	128	130
1930	554	98	1.05	113	582	112	121	93
1931	608	108	.81	87	492	95	104	91
1932	442	78	.55	59	243	47	89	53
1933	292	52	.82	88	239	46	87	53
1934	462	82	.72	77	333	64	96	67
1935	598	106	.71	76	425	82	99	83
1936	563	100	1.20	129	676	130	99	131
1937	506	89	1.15	123	582	112	105	107
1938	654	116	.70	75	458	88	99	89
1939	506	89	.90	97	455	88	98	90
1940	300	53	1.15	123	345	66	99	67
1941	429	76	1.25	134	536	103	105	98
1942	518	92	1.40	150	725	140	121	116
1943	435	77	2.30	247	1,000	193	136	142
1944	450	80	2.25	241	1,012	195	145	134
1945	540	96	2.50	268	1,350	260	151	172
1946	382	68	2.10	225	802	154	165	93
1947	281	50	2.30	247	646	124	192	65
1948	336	59	2.75	295	924	178	207	86
1949	308	54	2.75	295	847	163	200	82
1950	330	58	2.45	263	808	156	204	76
1951	315	56	2.50	268	788	152	225	68
1952	280	50	2.70	241	756	146	229	64

Table 40. - Snap beans (early fall market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1922-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1922	21	8	1.75	175	37	14	121	12
1923	56	22	1.85	185	104	41	127	32
1924	68	26	1.85	185	126	49	128	38
1925	157	60	1.85	185	290	113	131	86
1926	214	82	1.65	165	353	138	128	108
1927	194	75	1.30	130	252	98	127	77
1928	234	90	1.55	155	363	142	129	110
1929	300	115	1.10	110	330	129	128	101
1930	151	58	1.03	103	156	61	121	50
1931	169	65	.95	95	161	63	104	61
1932	143	55	.60	60	86	34	89	38
1933	185	71	.68	68	126	49	87	56
1934	270	104	.80	80	216	84	96	88
1935	269	103	1.00	100	269	105	99	106
1936	273	105	.90	90	246	96	99	97
1937	220	85	1.35	135	297	116	105	116
1938	278	107	.80	80	222	87	99	88
1939	260	100	.95	95	247	96	98	98
1940	352	135	.65	65	229	89	99	90
1941	120	46	1.65	165	198	77	105	73
1942	132	51	1.90	190	251	98	121	81
1943	141	54	2.40	240	338	132	136	97
1944	165	63	2.45	245	404	158	145	109
1945	255	98	2.75	275	701	274	151	181
1946	261	100	2.40	240	626	244	165	148
1947	120	46	2.40	240	288	112	192	58
1948	161	62	2.30	230	370	144	207	70
1949	168	65	1.50	150	195	76	200	38
1950	168	65	2.20	220	370	144	204	71
1951	135	52	2.95	295	398	155	225	64
1952	82	32	3.25	325	266	104	229	45

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Table 41. - Cabbage: Volume sold, season average price received by farmers, cash income sales, and purchasing power, Louisiana, 1918-1952

Year	Quantity sold (tons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1918	5.6	44	55.00	276	308	123	138	89
1919	6.2	49	52.50	264	326	130	157	83
1920	10.4	82	40.20	202	418	167	171	98
1921	10.1	79	22.50	113	227	91	124	73
1922	10.0	78	20.00	100	200	80	121	66
1923	11.0	86	42.70	214	470	188	127	148
1924	6.3	49	48.80	245	307	123	128	96
1925	15.0	118	22.50	113	338	135	131	103
1926	13.5	106	35.20	177	475	190	128	148
1927	15.4	121	21.80	109	336	134	127	106
1928	15.8	124	23.10	116	365	146	129	113
1929	14.6	114	22.10	111	323	129	128	101
1930	6.9	54	35.80	180	247	99	121	82
1931	17.8	139	16.60	83	295	118	104	113
1932	12.8	100	26.50	133	339	135	89	152
1933	10.6	83	21.60	108	229	91	87	105
1934	26.0	204	10.60	53	276	110	96	115
1935	8.3	65	23.00	115	191	76	99	77
1936	12.6	99	18.50	93	233	93	99	94
1937	13.9	109	23.00	115	320	128	105	122
1938	14.4	113	14.60	73	210	84	99	85
1939	14.6	114	20.50	103	299	119	98	121
1940	14.6	114	24.00	120	350	140	99	141
1941	19.3	151	22.00	110	425	170	105	162
1942	24.5	192	16.50	83	404	161	121	133
1943	16.3	128	67.50	339	1,100	439	136	323
1944	32.6	255	28.00	141	913	364	145	251
1945	33.8	265	26.00	131	879	351	151	232
1946	34.8	273	40.00	201	1,392	555	165	336
1947	36.0	282	19.80	99	713	285	192	148
1948	20.0	157	45.20	227	904	361	207	174
1949	22.3	175	29.00	146	647	258	200	129
1950	26.0	204	15.40	77	400	160	204	78
1951	6.3	49	61.60	309	388	155	225	69
1952	15.0	118	58.00	291	870	347	229	152

Table 42. Watermelons: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1934-1952

(1935-1939 = 100)

Year	Quantity sold (melons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1934	696	54	85	78	59	42	96	44
1935	899	70	90	83	81	58	99	59
1936	1,274	99	100	92	127	91	99	92
1937	1,680	130	96	89	161	115	105	110
1938	1,334	104	113	104	151	108	99	109
1939	1,250	97	143	132	179	128	98	131
1940	1,260	98	156	144	197	141	99	142
1941	972	76	169	156	164	117	105	111
1942	840	65	225	208	189	135	121	112
1943	810	63	435	401	352	252	136	185
1944	1,120	87	500	461	560	401	145	277
1945	950	74	520	480	494	353	151	234
1946	943	73	420	387	396	283	165	172
1947	868	67	356	328	309	221	192	115
1948	625	49	450	415	281	201	207	97
1949	644	50	407	375	262	187	200	94
1950	567	44	475	438	269	192	204	94
1951	1,014	79	470	434	477	341	225	70
1952	875	68	425	392	372	266	229	116

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Table 43. - Beets: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1927-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1927	180	91	0.50	110	90	98	127	77
1928	464	234	.56	123	260	283	129	219
1929	425	215	.48	105	204	222	128	173
1930	299	151	.64	140	191	208	121	172
1931	257	130	.36	79	93	101	104	97
1932	242	122	.45	99	109	119	89	134
1933	218	110	.38	83	83	90	87	103
1934	297	150	.30	66	89	97	96	101
1935	270	136	.48	105	130	142	99	143
1936	188	95	.40	88	75	82	99	83
1937	218	110	.55	121	120	131	105	125
1938	154	78	.40	88	62	68	99	69
1939	160	81	.45	99	72	78	98	80
1940	130	66	.50	110	65	71	99	72
1941	122	62	.50	110	61	66	105	63
1942	80	40	.75	164	60	65	121	54
1943	77	39	1.15	252	89	97	136	71
1944	63	37	1.15	252	72	78	145	54
1945	50	25	1.15	252	58	63	151	42
1946	55	28	1.15	252	63	69	165	42
1947	48	24	1.00	219	48	52	192	27
1948	36	18	1.30	285	47	51	207	25
1949	28	14	1.45	318	41	45	200	22
1950	30	15	1.15	252	34	37	204	18
1951	7	4	2.15	471	15	16	225	7
1952	6	3	2.10	461	13	14	229	6

Table 44. - Cucumbers (late spring market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1923-1952

(1935-1939 = 100)

(1933-1937 = 100)								
Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
Late spring market								
1923	21	47	1.80	228	38	107	127	84
1924	45	100	1.75	222	79	223	128	174
1925	35	78	1.95	247	68	192	131	147
1926	56	124	1.60	203	90	254	128	198
1927	55	122	1.20	152	66	186	127	146
1928	76	169	1.25	158	95	268	129	208
1929	59	131	1.31	166	77	218	128	170
1930	78	173	1.06	134	83	234	121	193
1931	48	107	.94	119	45	127	104	122
1932	45	100	.60	76	27	76	89	85
1933	34	76	.58	73	20	56	87	64
1934	36	80	.50	63	18	51	96	53
1935	54	120	.70	89	38	107	99	108
1936	42	93	1.00	127	42	119	99	120
1937	44	98	.85	108	37	105	105	100
1938	40	89	.55	70	22	62	99	63
1939	45	100	.85	108	38	107	98	109
1940	44	98	1.00	127	44	124	99	125
1941	58	129	.82	104	48	136	105	130
1942	57	127	1.00	127	57	161	121	133
1943	43	96	2.30	291	99	280	136	206
1944	100	222	2.10	266	210	593	145	409
1945	81	180	2.30	291	186	525	151	348
1946	100	222	1.65	209	165	466	165	282
1947	48	107	1.65	209	79	223	192	116
1948	75	167	2.50	316	188	531	207	257
1949	52	116	1.95	247	101	285	200	142
1950	60	133	1.80	228	108	305	204	150
1951	57	127	1.50	190	86	243	225	108
1952	60	133	2.55	323	153	432	229	189

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Table 45. - Cucumbers (early fall market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1928-1952
(1935-1939 = 100)

(1939=1939-100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
Early fall market								
1928	70	86	1.40	156	98	145	129	112
1929	65	80	1.25	140	81	119	128	93
1930	60	74	.98	109	59	87	121	72
1931	71	88	.89	99	63	93	104	89
1932	76	94	.92	103	70	103	89	116
1933	74	91	.90	100	67	99	87	114
1934	50	62	1.00	112	50	74	96	77
1935	64	79	.90	100	58	86	99	87
1936	68	84	.65	73	44	65	99	66
1937	52	64	1.35	151	70	103	105	98
1938	81	100	.90	100	73	108	99	109
1939	138	170	.68	76	94	139	98	142
1940	72	89	1.05	117	76	112	99	113
1941	65	80	1.15	128	75	111	105	106
1942	64	79	2.85	318	182	268	121	221
1943	105	130	3.20	357	336	496	136	365
1944	126	156	1.35	151	170	251	145	173
1945	100	123	3.50	391	350	516	151	342
1946	144	178	2.00	223	288	425	165	258
1947	54	67	3.35	374	181	267	192	139
1948	58	72	2.30	257	133	196	207	95
1949	81	100	1.80	201	117	173	200	86
1950	121	149	2.00	223	242	357	204	175
1951	50	62	2.65	296	132	246	225	109
1952	94	116	2.00	223	188	277	229	121

Table 46. - Tomatoes (fresh market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1925-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1925	102	48	3.00	316	306	155	131	118
1926	128	61	1.80	189	230	116	128	91
1927	151	72	1.00	105	151	76	127	60
1928	118	56	1.25	132	148	75	129	58
1929	98	47	1.25	132	122	62	128	48
1930	120	57	1.10	116	132	67	121	55
1931	127	60	1.25	132	159	80	104	77
1932	142	67	1.45	153	206	104	89	117
1933	197	94	.90	95	177	89	87	102
1934	220	104	.70	74	154	78	96	81
1935	192	91	.75	79	144	73	99	74
1936	210	100	1.00	105	210	106	99	107
1937	196	93	1.25	132	245	124	105	118
1938	239	113	.60	63	143	72	99	73
1939	216	103	1.15	121	248	125	98	128
1940	264	125	.80	84	211	107	99	108
1941	224	106	1.15	121	258	130	105	124
1942	200	95	1.80	189	360	182	121	150
1943	160	76	3.50	368	560	283	136	208
1944	130	62	3.25	342	422	213	145	147
1945	180	85	3.35	353	603	305	151	202
1946	130	62	3.50	368	455	230	165	139
1947	108	51	2.55	268	275	139	192	72
1948	120	57	3.50	368	420	212	207	102
1949	126	60	2.55	268	321	162	200	81
1950	98	47	5.70	600	559	284	204	138
1951	82	39	3.70	389	303	153	225	68
1952	77	37	5.50	579	424	214	229	93

Table 47. - Onions (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1918-1952

Year	Quantity sold (50 lbs.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1918	296	197	1.60	212	474	429	138	311
1919	155	103	2.85	377	442	400	157	255
1920	171	114	1.86	246	318	288	171	168
1921	208	139	.95	126	198	179	124	144
1922	330	220	1.51	200	498	450	121	372
1923	108	72	1.79	237	193	175	127	138
1924	207	138	.89	118	184	166	128	130
1925	278	185	1.36	180	378	342	131	261
1926	352	235	1.17	155	412	373	128	291
1927	313	209	1.22	161	382	345	127	272
1928	299	199	.88	116	263	238	129	184
1929	286	191	1.08	143	309	279	128	218
1930	76	51	1.15	152	87	79	121	65
1931	99	66	1.00	132	99	90	104	87
1932	96	64	.80	106	77	70	89	79
1933	35	23	.88	116	31	28	87	32
1934	134	89	.50	66	67	61	96	64
1935	98	65	.83	110	81	73	99	74
1936	119	79	.88	116	105	95	99	96
1937	184	123	.65	86	120	108	105	103
1938	170	113	.72	95	122	110	99	111
1939	179	119	.70	93	125	113	98	115
1940	115	77	1.30	172	150	136	99	137
1941	170	113	1.08	143	184	166	105	158
1942	209	139	.88	116	184	166	121	137
1943	162	108	1.65	218	267	241	136	177
1944	180	120	2.60	344	468	423	145	292
1945	220	147	2.10	278	462	418	151	277
1946	190	127	2.20	291	418	380	165	230
1947	124	83	1.70	225	211	191	192	99
1948	112	75	2.60	344	291	263	207	127
1949	130	87	2.00	265	260	235	200	118
1950	114	76	1.50	198	171	155	204	76
1951	36	24	2.15	284	77	70	225	31
1952	32	21	3.35	443	107	97	229	42

Table 48. - Garlic (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1932-1952

(1935-1939 = 100)

Year	Quantity sold (cwt.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1932	7	78	2.50	63	18	51	89	57
1933	6	67	5.50	139	33	93	87	107
1934	7	78	3.50	89	24	67	96	70
1935	9	100	2.50	63	22	62	99	63
1936	7	78	4.50	114	32	90	99	91
1937	8	89	4.50	114	36	101	105	96
1938	11	122	4.50	114	50	140	99	141
1939	10	111	3.75	95	38	107	98	109
1940	10	111	4.00	101	40	112	99	113
1941	11	122	6.00	152	66	185	105	176
1942	17	189	4.00	101	68	191	121	158
1943	15	167	5.00	127	75	211	136	155
1944	13	144	8.00	203	104	292	145	201
1945	12	133	15.50	392	186	522	151	346
1946	11	122	20.00	506	220	618	165	375
1947	12	133	13.50	342	162	455	192	237
1948	10	111	10.50	266	105	295	207	143
1949	9	100	9.80	248	88	247	200	124
1950	9	100	9.20	233	83	233	204	114
1951	1	11	10.60	268	11	31	225	14
1952	1	11	10.00	253	10	28	229	12

Table 49. - Shallots (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1937-1952

(1935-1939 = 100)								
Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
Spring market								
1937	347	122	.67	92	232	113	105	108
1938	256	90	.98	134	251	123	99	124
1939	278	98	.45	62	125	61	98	62
1940	272	96	.60	82	163	80	99	81
1941	266	94	.95	130	253	124	105	118
1942	312	110	.80	110	250	122	121	101
1943	196	69	1.80	247	353	172	136	126
1944	168	59	2.50	342	420	205	145	141
1945	231	81	1.35	185	312	152	151	101
1946	220	78	1.90	260	418	204	165	124
1947	200	70	1.80	247	360	176	192	92
1948	190	67	1.55	212	294	144	207	70
1949	96	34	2.10	288	202	99	200	50
1950	209	74	1.60	219	334	163	204	80
1951	214	75	1.80	247	390	190	225	84
1952	273	96	1.50	205	410	200	229	87
Winter market								
1937	374	124	.75	93	280	119	105	112
1938	234	78	1.15	142	269	115	99	116
1939	348	115	.55	68	191	81	98	117
1940	324	107	.70	86	227	97	99	98
1941	229	76	.90	111	206	88	105	84
1942	370	123	.85	105	314	134	121	111
1943	254	84	1.25	154	318	136	136	100
1944	171	57	2.25	278	385	164	145	113
1945	378	125	1.85	228	699	298	151	197
1946	448	148	1.90	235	851	363	165	220
1947	243	81	2.15	265	522	223	192	116
1948	319	106	1.70	210	542	231	207	112
1949	290	96	1.65	204	478	204	200	102
1950	250	83	2.40	296	600	256	204	125
1951	240	80	2.80	346	677	289	225	128
1952	387	128	2.10	259	789	336	229	147

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Table 50. - Eggplant (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1925-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1925	76	89	1.05	167	80	150	131	115
1926	70	82	1.05	167	74	139	128	109
1927	70	82	1.00	159	70	132	177	104
1928	108	127	.90	143	97	182	129	141
1929	100	118	1.30	206	130	244	128	191
1930	88	104	.87	138	77	145	121	120
1931	72	85	1.50	238	108	203	104	195
1932	79	93	1.00	159	79	148	89	166
1933	73	86	.75	119	55	103	87	118
1934	82	96	.50	79	41	77	96	80
1935	101	119	.75	119	76	143	99	144
1936	55	65	.60	95	33	62	99	63
1937	69	81	.65	103	45	85	105	81
1938	112	132	.45	71	50	94	99	95
1939	88	104	.70	111	62	117	98	119
1940	84	99	.85	135	71	133	99	134
1941	77	91	.90	143	69	130	105	124
1942	72	85	1.20	190	86	162	121	134
1943	85	100	1.50	238	128	241	136	177
1944	70	82	1.35	214	94	177	145	122
1945	60	71	1.95	310	117	220	151	146
1946	54	64	1.60	254	86	162	165	98
1947	51	60	1.45	230	74	139	192	72
1948	52	61	1.35	214	70	132	207	64
1949	45	53	1.60	254	72	135	200	68
1950	45	53	1.30	206	58	109	204	53
1951	45	53	1.30	206	58	109	225	48
1952	45	53	1.85	294	83	156	229	68

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Table 51. - Green peppers (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1924-1952

(1935-1939 = 100)								
Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1924	149	59	1.30	205	194	126	128	98
1925	272	108	1.20	189	326	213	131	163
1926	300	119	1.40	221	420	274	128	214
1927	288	114	1.20	189	346	226	127	178
1928	294	116	.90	142	265	173	129	134
1929	260	103	.93	147	242	158	128	123
1930	172	68	.70	110	120	78	121	64
1931	242	96	.65	103	157	102	104	98
1932	117	46	.85	134	99	65	89	73
1933	220	87	.60	95	132	86	87	99
1934	152	60	.48	76	73	48	96	50
1935	279	111	.49	77	137	89	99	90
1936	195	77	.48	76	94	61	99	62
1937	240	95	.60	95	144	94	105	90
1938	352	139	.50	79	176	115	99	116
1939	196	78	1.10	174	216	141	98	144
1940	161	64	.80	126	129	84	99	85
1941	260	103	.60	95	156	102	105	97
1942	163	65	1.15	181	187	122	121	101
1943	242	96	3.25	513	786	512	136	376
1944	280	111	1.90	300	532	347	145	239
1945	280	111	2.20	347	616	402	151	266
1946	200	79	2.20	347	440	287	165	174
1947	225	89	2.80	442	630	411	192	214
1948	352	139	1.80	284	634	413	207	200
1949	291	115	2.60	410	757	493	200	246
1950	246	97	1.50	237	330	215	204	105
1951	406	161	.95	150	386	252	225	80
1952	364	144	4.45	702	1,620	1,056	229	461

Table 52. - Carrots (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1923-1952

(1935-1939 = 100)

Year	Quantity sold (bu.)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1923	329	123	.78	159	257	199	127	157
1924	298	112	1.03	210	307	237	128	185
1925	573	215	.70	143	401	310	131	237
1926	645	242	.70	143	452	349	128	273
1927	1,002	376	.51	104	511	395	127	311
1928	428	161	.51	104	218	168	129	130
1929	389	146	.62	127	241	186	128	145
1930	288	108	.50	102	144	111	121	92
1931	231	87	.31	63	72	56	104	54
1932	220	83	.40	82	88	68	89	76
1933	189	71	.37	76	70	54	87	62
1934	252	95	.32	65	81	63	96	66
1935	234	88	.60	122	140	108	99	109
1936	228	86	.40	82	91	70	99	71
1937	262	98	.60	122	157	121	105	115
1938	286	107	.40	82	114	88	99	89
1939	323	121	.45	92	145	112	98	114
1940	240	90	.55	112	132	102	99	103
1941	250	94	.55	112	138	107	105	102
1942	225	84	.80	163	180	139	121	115
1943	187	70	1.05	214	196	151	136	111
1944	158	59	1.15	235	182	141	145	97
1945	165	62	1.30	265	214	165	151	109
1946	148	56	1.50	306	222	172	165	104
1947	131	49	1.45	296	190	147	192	77
1948	121	45	1.70	347	206	159	207	77
1949	116	44	1.40	286	162	125	200	62
1950	100	38	1.40	286	140	108	204	53
1951	30	11	2.90	592	87	67	225	44
1952	33	12	3.10	633	102	79	229	34

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Table 53. - Spinach (market): Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1925-1952

Year	Quantity sold (bu.)	(1935-1939 = 100)						
		Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1925	200	164	.40	84	80	137	131	105
1926	170	139	.50	105	85	146	128	114
1927	182	149	.45	95	82	141	127	111
1928	225	184	.48	101	108	186	129	144
1929	200	164	.48	101	96	165	128	129
1930	100	82	.50	105	50	86	121	71
1931	105	86	.40	84	42	72	104	69
1932	102	84	.40	84	41	70	89	79
1933	126	103	.30	63	38	65	87	75
1934	142	116	.29	61	41	70	96	73
1935	102	84	.45	95	46	79	99	80
1936	112	92	.35	74	39	67	99	68
1937	110	90	.60	126	66	113	105	108
1938	138	113	.50	105	69	119	99	120
1939	148	121	.48	101	71	122	98	124
1940	117	96	.55	116	64	110	99	111
1941	120	98	.60	126	72	124	105	118
1942	100	82	.75	158	75	129	121	107
1943	75	61	1.15	242	86	148	136	109
1944	70	57	1.05	221	74	127	145	88
1945	68	56	1.15	242	78	134	151	89
1946	63	52	1.20	252	76	131	165	79
1947	52	43	1.35	284	70	120	192	62
1948	49	40	1.45	305	71	122	207	59
1949	46	38	1.50	315	69	119	200	60
1950	38	31	1.20	252	46	79	204	39
1951	18	15	1.90	399	34	59	225	26
1952	21	17	1.45	305	30	52	229	23

Table 54. - Truck crops for commercial processing: Volume sold, season average price received by farmers, cash income from sales, and purchasing power, Louisiana, 1928-1952

(1935-1939 = 100)

Year	Quantity sold (tons)	Index of quantity sold	Season average price	Index of prices	Income from sales	Index		
						of income	of prices paid by farmers	of purchasing power
	1,000	per cent	dollars	per cent	1,000 dollars	per cent		
1928	2.10	58	61.40	283	129	165	129	128
1929	4.02	111	46.00	212	185	236	128	184
1930	6.23	172	32.40	149	202	258	121	213
1931	2.61	72	32.20	148	84	107	104	103
1932	1.84	51	23.80	110	44	56	89	63
1933	1.70	47	18.80	87	32	41	87	47
1934	1.53	42	21.60	99	33	42	96	44
1935	3.13	86	16.60	76	52	66	99	67
1936	2.13	59	21.10	97	45	57	99	58
1937	5.85	161	21.70	100	127	162	105	154
1938	4.51	124	22.40	103	101	129	99	130
1939	2.50	69	26.80	123	67	85	98	87
1940	5.10	141	24.00	110	122	156	99	158
1941	5.40	149	27.00	124	145	185	105	176
1942	7.80	215	37.70	174	293	374	121	309
1943	6.00	166	65.40	301	393	501	136	368
1944	4.50	124	59.50	274	276	352	145	243
1945	5.80	160	56.15	259	324	413	151	274
1946	3.98	110	70.35	324	280	357	165	216
1947	3.76	104	26.39	122	275	351	192	183
1948	1.86	51	68.30	314	127	162	207	78
1949	1.80	50	65.00	299	117	149	200	74
1950	3.80	105	40.25	185	153	195	204	96
1951	2.00	55	63.50	292	127	162	225	72
1952	1.30	36	70.55	325	92	117	229	51



EVALUATIVE PROCESSES IN HOME ECONOMICS

I. FOODS AND NUTRITION

By
M. Ray Loree
and
Kathryn R. Mackensen



LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
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Louisiana State University
and
Agricultural and Mechanical College
Baton Rouge, Louisiana
June, 1953

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Foreword

This bulletin is written for the student of teaching to help refine the concepts of evaluation as an integral part in the teaching-learning process. Use of the bulletin is directed to teachers of Home Economics to aid in developing evaluative techniques and in using the results in the teaching-learning process.

The evaluation methods presented are selected as illustrative of methods that may be used in determining direction and depth of pupils development and effectiveness of teaching processes.

The illustrations are adapted from, (1) procedures which have been used in high school by students-teachers, pupils and the supervisory staff in developing, cooperatively, evaluation programs, and (2) from studies made by graduate students concentrating in the evaluation area. The selection of evaluation devices based on pupil-teacher experiences in the learning - teaching processes may offer encouragement to teachers and pupils in using materials developed in similar situations in developing their evaluation programs.

Plans made by the Research Division of the Home Economics Department included other bulletins illustrating techniques from a variety of subject matter areas usually a part of high-school home economics programs, including child growth and development, personal and family living, clothing, textiles and housing.

Dr. Clara Tucker, Head
Home Economics Department
Louisiana State University
and Mechanical College.

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PART I

RELATION OF EVALUATION IN THE TEACHING PROCESS

Role of Evaluation in Today's Schools

In the United States, our society expects men and women to be self-directed, emotionally stable, physically tireless and socially amiable human beings. These characteristics are not innate. From birth, frustration induces trial-and-error and imitative behavior as the individual strives to resolve his many problems and at the same time conform to social expectancies. Under favorable hereditary and environmental conditions, the individual learns to employ a logical sequence of thought to resolve frustration into reasonable satisfaction to himself and others. Not all children have equally favorable hereditary and environmental conditions in which to develop the ability to evaluate possible responses in various situations and to choose to behave rationally in solving problems.

Schools, in the United States, for most children, constitute one major influence in their lives. Those of us who teach in these schools recognize the importance of the development of knowledge, the acquisition of information and the growth of understanding. The responsibility of aiding children in choosing situations in which they may show ability to apply information, exercise judgement and grow in understanding is not assumed by all teachers. The need for such school experience is not recognized or is merely verbalized on by some teachers. The child's classroom environment is the reflection of the individual teacher's beliefs as to values in learning.

Each teacher who reads this booklet is likely to interpret it differently. It is written for those teachers who believe in the value of the acquisition of information and skills to the extent to which these learnings are directed toward the ability to apply, to interpret, to understand, to relate cause and effect, to solve problems. Otherwise, information becomes lifeless. Choosing appropriate responses in various situations constitutes the essence of the problem-solving process. The child learns as he evaluates the appropriateness of his responses in achieving his purposes. Evaluation becomes an integral part of the learning process.

We, in home economics and other educational areas, have not "discovered" evaluation. We are able to realize that evaluation is a natural process which, like some other natural processes, provides greater satisfaction when guided toward expressed goals and achievement. This requires the creative use of evaluation in guiding learners into habits of logical thought sequences which relate cause to effect more clearly.

A state of confusion sometimes exists when efforts are made to develop evaluative procedures. Some teachers conceive of evaluation as synonymous to measurement. Other teachers conceive of evaluation only as providing an opportunity to students to respond to a problem situation.

Evaluation makes use of measurement but is not synonymous with it. How do the two differ? Measurement refers to observations which can be expressed quantitatively. It is concerned with the question of "how much". Evaluation recognizes the need to know "how much" but is especially concerned with the question "what value". This emphasis upon values distinguishes evaluation from measurement most clearly.

Evaluation may also make use of the problem-solving processes; but evaluation as a process and problem-solving as a process are not synonymous. The evaluative procedures must be such that the responses of the students yield precise information concerning their behavioral status. Validity, reliability, and objectivity are desirable characteristics in evaluative devices, just as they are in measuring instruments.

The fact that evaluation is concerned with values has special meaning in a democratic society. In a free society, the emphasis of education must be on rationality rather than conformity or indoctrination, if the free society is to preserve itself. Experienced teachers know that it is relatively easy to guide most children into a state of conformity. The "non-conformists" become the "children with problems". The ideal students in some schools are those children who "conform" to the rules and regulations. Such behavior can be forced upon occasion and may, for the immediate health or welfare of the individual, become temporarily expedient. Anyone can secure that kind of education for himself. Try running traffic lights, stepping on fruit peels, or placing pans of hot fat so that the handles of the pans extend into passage ways around stoves - try these practices consistently and sooner or later one is likely to "conform," dead or alive. Actually, the learning will involve some evaluation, but little intellect. Schools have responsibility for helping students develop ways of learning that are creative and constructive: (1) Searching for facts and principles, (2) Applying facts and principles in situations, (3) Appraising the effects of the applications, and (4) Establishing values to guide future behavior. Basically, these are the elements upon which evaluation procedures may be built. Democratic living depends on individuals who have these habits of thought. The development of these habits requires a disciplined intellect.

Evaluative procedures in the democratic school cannot afford to ignore the intellectual development of the child. There is an important place in an evaluative program for tests that measure the student's knowledge, his ability to apply principles, to interpret data in a given subject area, and his ability to think logically in problem solving situations.

An example, from foods and nutrition may clarify the role evaluation may play in the teaching and learning process. Let us suppose that an important general objective for a Home Economics teacher is to forward the development of her students to intelligently direct their own lives. Let us further suppose that our teacher has set up, among others, two objectives for her students in foods and nutrition: (1) To develop an ability to select an adequate diet; and (2) To develop the habit of selecting for self the best diet nutritional opportunity affords. Now let us examine how evaluative procedures might yield information concerning the

progress of students in both the general objective and the two foods and nutrition objectives. A pre-instruction and post-instruction test on nutrition understandings could yield information concerning the progress of students in their ability to select an adequate diet. Similarly food habit records taken before and after instruction could give information on whether students have improved in their food habits. Our home economics teacher in analyzing the test results of her class may be particularly interested in studying further two classes of students: (1) Students who have improved in their nutrition understandings but not in their food habits; and (2) Students who have improved in their food habits but not in their nutrition understandings. Both classes may represent students who are not making satisfactory progress toward the general objective of intelligently directing their own lives. Certainly the student who exhibits the intellectual ability to select an adequate diet but who deliberately chooses a poor diet has not exhibited an ability to intelligently direct his own life. It is equally true that the student who changes his food habits merely to conform to the teacher's expectancies and without understanding the relation of the changes he has made to his own welfare, has not exhibited an ability to intelligently direct his own life.

The above illustration points up three characteristics of evaluation in a democratic society:

1. Information concerning student development is structured in such a way that judgements can be made in relation to a significant behavioral development (increased self-direction).
2. The evaluative devices are such as to yield accurate information on the behavioral status of the child (that is both the nutritional understandings tests and the food-habit-record yield valid, reliable and objectively obtained scores).
3. The significant behavioral development (increased self-direction) represents a democratic value.

Teaching Procedures Directed Toward Releasing the Capacities of the Students for Learning.

To become self-directed, students need experience in setting up goals, choosing methods of reaching these goals and determining values to themselves in these activities. Evaluative procedures developed as an integral part of the teaching and learning process have been used to facilitate this kind of learning and hold promise of unexplored values. Below, is a descriptive outline of the "stages" in teaching procedures where cooperative teaching and learning may be used in order to increase the students understanding of his role in learning and to direct the teaching so as to release the capacity of the student to learn. The outline is presented at the teacher-level and can be interpreted at the pupil level in situations where pupils and teachers are together:

1. Cooperative goal-seeking procedures.
 - 1.1 Determining the needs of learners.

- 1.11 Arising from individual differences due to individual past experiences.
 - 1.12 Arising from developmental differences in physical, emotional, social and intellectual potentiality.
- 1.2 Determining the interests of students.
 - 1.21 Kinetic interests as shown in records of the activities pupils presently engage in, when a choice of activity is given.
 - 1.22 Potential interests, set into motion by exposure to broadened experiences.
- 1.3 Determining existing patterns of living in the current environment of the learner.
 - 1.31 Modes in family living
 - 1.32 Modes in community living
 - 1.33 Values and beliefs held by individuals, families and community
 - 1.34 Factors influencing current family living.
- 1.4 Determining subject matter needs in home economics with individuals and groups.
 - 1.41 Subject matter known to the learner.
 - 1.42 Subject matter unknown to the learner, essential for satisfactory problem-solving in individual and family living.
- 2. Cooperative choice of activities through which the goals may be reached.
 - 2.1 Evaluating possible learning experiences which hold promise for the achievement of the expressed goals of an individual or a group.
 - 2.2 Evaluating possible limitations inherent in some learning experiences.
 - 2.21 Learning experiences which, in general may seem valid, but in a given situation may be non-achievable.
 - 2.22 Learning experiences which will permit the achievement of the goals and are possible in the known situation.
- 3. Cooperative exercise of judgement as to progress toward expressed goals.
 - 3.1 Determining satisfactions in past learning experiences
 - 3.2 Determining lack of satisfaction in past learning experiences
 - 3.3 Obtaining evidences of achievement of objectives
 - 3.31 Increased knowledge and abilities

- 3.32 Developed interests and attitudes
 - 3.33 Improved habits and practices
 - 3.34 New manipulative skills
4. Cooperative determination of next steps in choice of next goals and learning experiences.

EXAMPLE OF UNIT IN NUTRITION AND FOODS ILLUSTRATING EVALUATIVE PROCESSES IN TEACHING

I. Situation

- A. Urban area, Baton Rouge, Louisiana State University
- B. Wide range in parent occupations and incomes
- C. Wide range in past experiences in home economics among the class members
- D. Some students bring lunches; many eat at local hamburger stands; many eat at the L.S.U. cafeteria. Nearly all students have breakfast and dinner at home.

II. Approach

The class had been helping and observing nursery school children as they ate lunch and followed other routine patterns at the Louisiana State University Nursery School. Since we were concerned with food for children and realized the need for specific foods, well-planned and prepared, we wondered if it were reasonable to ask, "Do adults need food which is carefully chosen to satisfy needs of the adult body?" "Are high-school girls adults or growing people?" "How do you know whether you are eating foods which are adequate for your needs?" We recalled the popular song, "Straighten Up and Fly Right". Are you a Mr. Straighten Up and Fly Right".

Finding Evidence of Some Nutritional Problems¹

Problems	Activities
1. How can we determine whether or not we are really healthy?	Develop a physical fitness index.
a. What are some evidences of physical fitness other than freedom from illness?	(1) Take weight, height measurements.
b. What are some evidences in individual cases of physical fitness and lack of physical fitness?	(2) Examine teeth for visible cavities. If parents approve have girls visit a dentist to have teeth examined.
c. What habits are essential to physical fitness?	(3) Examine skin, hair, and eyes.
	(4) Recall number of colds since Christmas. Keep record of incidence of colds in the class.

Class set-up first objectives:

I. To secure information on ways for specific individuals to:

- (1) Clear skin of blemishes
- (2) Increase weight
- (3) Decrease weight
- (4) Improve dispositions
- (5) Decrease tooth decay

What foods are necessary to health when no special needs exist?²

Summarize information on foods necessary to satisfy general body needs.

Analysis-

¹Cooperative goal seeking procedures. "...Students need experience in setting up goals ... and determining values to themselves in the activity...."

²Determining subject matter needs.

2.1 Information known to the individual

2.2 Information needed to solve nutrition problems unknown to the individual.

Outcomes	Aids
Conclusions for each individual. ³	
(1) Underweight	(1) Scales
(2) Overweight	(2) Height-weight charts
(3) Cavities	(3) Physiology texts
(4) Skin, hair, eye conditions.	(4) Guide sheet to record findings and develop physical fitness index.
(5) Disposition cheerful	(5) 8" x 12" mirrors for each two girls.
(6) Calm quite nerves	(6) Each girl devise some form or use a notebook to record regular weekly weight and incidence of cold or other evidences of state of health.
	(7) Commercial charts on structure of parts of the body.
Information	
	(1) Texts
	(2) Previous learning
	(3) Nutrition charts, U.S.D.A.

³Kinetic interests of the specific individuals in the group.

Problems	Activities
If a girl is over-weight, what may be some of the causes?	Become familiar with the metabolism of sugar, starches, and fats.
If a girl is underweight, what may be some of the causes?	Make a record of the days activities. Find records of energy studies made by research workers.
Are problems of correcting over-weight or underweight related to the care of the skin?	Compare records of studies made with own activities.
How much energy (calories) do individual girls require daily?	Keep a record of foods eaten over a period of time. Analyze these records to determine value of foods eaten in terms of individual general and specific needs. ⁴
	Isolate several menus and add to them or take away foods which are needed or which are desirable in terms of individual needs. ⁴
	Visit the cafeteria when there is no rush hour and choose combinations of foods which will: (1) Be suitable to individual energy needs. (2) Be high in protective and regulatory foods.⁴
	Make arrangements for girls to show their mothers records of menus planned and foods chosen at the cafeteria. Encourage girls to ask mothers to let them include foods in the days diet which they need. Report on reactions of the family to the menus planned. ⁵
	Study the structure of the skin. Relate functions of foods to health of the mucous membranes, skin, and muscles. Demonstrate methods of external care of the skin.

Analysis-

⁴Evaluative process to determine behavioral status of individuals in food habits and understandings.

⁵Evaluative process to determine values held by families.

Outcomes	Aids
Information Understanding of the way fats are stored in the body.	Texts Commercial Life Insurance leaflets on underweight and overweight.
Individual understands her own energy needs.	
Appreciation that accurate nutritional studies of energy needs have been made, and can be used in making comparative studies.⁶	<u>Planned Nutrition</u> - Davis Visit hospital or college department to see a metabolic test given.
Skill in planning and in also in buying prepared foods which meet individual needs.	
Realization that methods of cooking and seasoning foods influence nutritional value of foods.⁶ (Later this realization was used as a base for setting up of additional objectives.)	Textbooks Cafeteria The homes of the girls
Understanding that securing proper foods is a family as well as an individual problem.⁶	A student in the class who was under the supervision of a doctor because of skin eruptions voluntarily reported to the class controls which the doctor has placed on her diet and explained why as far as she understood.⁶
Understand the metabolism of proteins, minerals, and vitamins	Commercial charts. Films. Teacher - pupil made diagrams Textbooks.

⁶Potential interests, set in motion by exposure to broadened experiences.

Problems	Activities
When you were in the 8th grade you made a poster - title: Foods That Make Us Go, Glow, Grow. What is the scientific basis for this poster?⁷ What are some of the problems which homemakers meet when planning daily food? (1) Costs (2) Time required for preparation (3) Family likes (4) Availability of foods (5) Others	Analyze for detail information: "Our bodies need food for growth and repair, energy and protective and regulatory purposes."
Further Objectives Set-up: II. To secure information on the food sources of various nutrients. III. To understand the reasons for costs of foods and why it is necessary to use different foods at various seasons. IV. To understand Marketing processes. V. To develop ability to purchase foods wisely.	
	Make a list of foods needed daily by individuals. Study food value charts to list several foods in each group of those needed. Plan a study sheet to be carried to a store to see comparative prices. Field trip to stores.

Analysis:

⁷Exploratory, evaluative process to determine understandings from past experiences.

Problems	Activities
What foods do we find in the stores which may be used interchangeable from a nutritional viewpoint? What is the meaning of the "64" which we see on some crates containing grapefruit? Etc. Summarize results of the trip to the store. Why do all canned goods show on the label: (1) Content of the can (2) Weight of the contents (3) The name of the packer?	While at the market, as pre-planned, the pupils observe: (1) Labels on the crates (2) Labels on the canned foods (3) Packages of foods Purchase some of the foods for a laboratory study of the comparative value of the various grades, brands, packs, etc.
Further Objectives Set-up: VI. To gain some information about the Pure Food and Drug Act. VII. To gain some appreciation for marketing systems. VIII. To develop judgement in reading labels. IX. To understand that further work must be done in food labeling and grading to make the wiser purchase of foods possible.	
What is the value of food legislation? What local legislation do we have? How can we find out what local food legislation exists? What other legislation is needed?	Class suggests several activities:⁸ Visit local officials in charge of health controls. Secure name of agencies from the mayor-president's office. Organize our questions. Make appointments. Use our library. Class decides on committees needed to obtain information. Sociometric test given to establish committee membership:⁸

Analysis

⁸Cooperative identification of activities through which objectives may be achieved.

⁸Evaluative process in choosing committee membership.

Outcomes	Aid
Ability to analyze problems.	Labels Packaged foods Textbooks
Ability to form rules of action based on information, judgements, understanding.	
Appreciation of: (1) Variety of foods on the market, (2) Complexity of food marketing, and (3) Uniformity of some labels.	Personal records. Personal observations Personal experiences
Ability to purchase more intelligently.	
Ability to recognize community resources.	
Understanding value of health protection in a community.	Resource people: Mayor-president Doctors and nurses Butchers Grocerymen Food inspectors School administrators
Ability to meet civic leaders and talk to them on community problems.	
Understanding the importance of participating in community programs. ⁹	Copies of Pure Food and Drug Act.

⁹Determining one type of community service (social income) which influences current family living.

Problems	Activities
Several weeks have gone by since we first began to keep a record of our weight changes and evidence of clearer complexion. Let's look once more at our records and at ourselves. Have you really followed the principles of wise food choices for yourself? Is it possible for us to see any evidence of corrected weight, improved skin, fewer cavities, improved dispositions?	Analyze height-weight records kept over the past weeks. Have girls re-examine skin, hair, and teeth. Recall that many health factors other than food affect physical fitness. Get opinions as to decreased feeling of fatigue, etc., if there is a real evidence of conscious effort to follow good health plans.¹⁰

Further Problems Recognized:

Do you recall that as we choose foods at the cafeteria, we pointed out some practices of cookery that will preserve more nutritive value than do some other methods?

Does it seem true or false to you that some foods might be well cooked according to nutritional standards yet be uninteresting to family members? Why?

Do you believe it might be very possible to season foods according to the general likes of the family and at the same time preserve most of the nutrients of the foods being prepared?¹¹

Analysis:

¹⁰Determining satisfactions and lack of satisfaction in past learning experiences.

¹¹Recognizing the influence of existing family attitudes toward foods on possible learning at school.

Outcomes	Aids
Ability to organize information Realization that maintaining physical fitness is a personal responsibility. Appreciation of nutritional opportunities in the United States.	Personal records Personal experiences Personal observations throughout the unit

Further Objectives Set-up:

- X. To develop ability to choose methods of cookery which pre-serve more nutritive value than do some other methods.
- XI. To develop skill in preparing foods attractively and to pre-serve nutritive values.
- XII. To develop the ability to plan, prepare, and serve foods so that they are:
 - (1) Nutritious
 - (2) Attractive
 - (3) Within our cost limits
 - (4) Possible ones to prepare with the equipment we have at home and here at school.
- XIII. To gain the ability to set attractive tables.
- XIV. To develop poise and graciousness as hostesses.
 - (1) Planning use of time, money and energy.
 - (2) Organizing various duties as hostesses.
 - (3) Following pleasing patterns in social customs and behaviour.

Problems	Activities
What are some of the types of foods that we should be able to prepare well in order to prepare entire menus?	List types of foods available and used in menus. Soups, main dishes, fruits, breads, desserts, etc.
Planning menus is an ever present responsibility at home.	Plan menus suitable for home use and in line with the individual needs of each person.
We Americans have a habit of planning a protein dish as our main dish in a menu. In the menus which you have just planned, let's select the protein dishes you have listed.	Organize work in laboratory to prepare main dishes with the principle ingredient protein. Practice good habits of organization, buying, cookery principles set up. Prepare some dishes which we have chosen for main dishes in the menus we have planned. Try to find more than one way to prepare each food.
Digression:¹² Is there value in refraining from licking your fingers? (List other violations of sanitation often observed).	Set up petri dishes with sterile agar-agar to show bacteria on dirty glass edges, unwashed fingers, licked fingers, bacteria carried by a cough, sneeze, etc. (Use controls and other approved methods in experiment).
List vegetables which we have included in our menus because of their color, nutritive value, flavor, or texture. Maybe, the vegetables you have planned in your menus, you have included for reasons other than those listed? What are the reasons, if any?	Experimental cookery procedures used in cooking leafy-green, yellow, red vegetables, starchy vegetables and rice.¹³
How can we prepare vegetables and preserve characteristics which are desirable in ready-to-eat vegetable dishes?	

Analysis:

¹²The teacher observed practices in handling foods and dishes which were very unsanitary. The bacteriology experiments were initiated by the teacher. Pupils joined in the study. "Potential interests, set into motion by broadened experiences."

¹³Evaluative process in teaching to develop understandings.

Outcomes	Aids
Appreciation of scope of "learning to cook".	Texts
Ability to plan menus: (1) Nutritionally adequate for the family. (2) Meet individual needs. (3) Attractive. (4) Achievable in the situation (5) Reasonable in cost.	Personal experience
Ability to cook protein dishes and practice good principles of protein cookery.	A study sheet used to help girls review ways to use in planning meals for specific groups --- The Smith Family and My Family -- is attached to this report. This device was used as an aid in keeping nutritional standards before the students. ¹⁴
Ability and pleasure in organization of work.	Texts
Realization of needs for sanitary processes of work.	Laboratory equipment. Agar-agar Petri dishes Magnifying glasses
Ability to wash dishes so that they are really clean.	
Understanding the effect of acids, alkalies, temperature and length of cooking on the taste, flavor, texture and color of vegetables.	

¹⁴ See appendix for evaluative device used. "The Smith Family and My Family."

Through problems chosen in class, work was directed toward objectives X, XI, XII, XIII, XIV during approximately the next four weeks. The development of these objectives was guided so that all objectives in the unit were incorporated and respected from day to day. Many menus were planned, tables set, service studied and practiced. A party buffet meal was served toward the last part of the unit.

The type of work done during this part of the unit has also been recorded many times in various published guides and for that reason the problems and activities chosen to achieve objectives X, XI, XII, and XIII, XIV are not recorded here.

Home Experiences

Each student had several home experience sheets fastened firmly in personal folders which are kept in a file case in the laboratory. The girls keep study sheets, tests, any records they choose in their own folders, but all have the experience sheets in the folders. These are examined and commented on in class from time to time. Many experiences were recorded by this group.

During this unit girls were encouraged to do many things, some of which were:

- (1) Shopped for or with their mothers. Many of the girls did a large part of every day shopping.
- (2) Practiced good buying habits.
- (3) Stored foods in the refrigerator so as to preserve the foods well.
- (4) Prepared menus on days when they were at home.
- (5) Prepared separate dishes whenever that dish could be fitted into the regular menu for the family.
- (6) Planned menus with mother, or for the family without mother's help, when she approved.

Searching for evidences of learning:¹⁵

A. As one culminating activity girls planned, prepared, served and judged a buffet luncheon to friends their own age and to several faculty members. The party was very successful and later a group of elementary teachers present at the luncheon, asked this class to cooperate with the first, second, and third grades in developing their nutrition program.

Analysis-

¹⁵Cooperative evaluative procedures. Students need experience in determining past successes and indicating future steps.

B. The class agreed to cooperate with the elementary students and their teachers. The foods and nutrition students used posters, charts, foods, and short skits with elementary pupils, abilities developed earlier in the child care unit were real assets in this work.¹⁶

C. The class wrote and produced "Pep and Personality", a two act play. This proved excellent as an evaluation device for testing information and practices for both the nutrition and foods, and child care unit.¹⁷ The play was presented before all children and faculty members of the elementary group and a large number of the parents of the young children were there as special guests.

D. Pencil-paper tests were also used to secure evidence of growth toward the objectives. The following outlines the objectives of the tests:¹⁸

- (1) To evaluate information acquired by the students.
 - (a) Nutrition
 - (b) Cookery
 - (c) Miscellaneous
- (2) To evaluate ability in food planning.
- (3) To evaluate judgement and skill in preparing foods.
- (4) To evaluate ability to organize and plan work.
- (5) To evaluate ability to serve foods pleasantly.
- (6) To evaluate understandings with which some problems in food and nutrition are solved.

E. Observers were used during the unit to gain evidence of improved practices in:¹⁹

- (1) Buying foods.
- (2) Preparing foods.
- (3) Serving foods.
- (4) Working as family members.
- (5) Working in a sanitary manner.

Analysis-

¹⁶Evaluation can show evidence of continuity, sequence and integration in learning.

¹⁷Recognizing and applying subject matter in a situation in which "others" are to learn.

¹⁸Teacher responsibility assumed in searching for evidence of achievement.

¹⁹Evaluation is a process as well as a product. Learning is facilitated if those who are to learn are aware of the processes involved as well as the product desired.

To identify evaluative teaching and learning procedures which may be cooperative in design, as has been done above, is futile unless predicated upon concepts of teaching which value student capacity and past experiences as important ingredients in the teaching and learning process. Teachers who try to develop cooperative goal-seeking procedures consistently on such tenuous bases as students "want to" expressions are, we believe, leading themselves into a very sobering experience. However, the use of cooperative goal-seeking procedures in evaluating past experiences and in identifying evidences of readiness to learn in future experiences invites the student to participate actively in the teaching process and creates a democratic atmosphere. It is the obligation of the teacher in the United States to foster creative, democratic practices in the schools. We are aware that learning can take place instantly as a result of traumatic experience, but due to the nature of the democratic philosophy, can find no valid place for the method in public schools.

It is possible to rely upon the capacity of the student to deal constructively with his life situation if the teacher's aim is directed toward releasing that capacity. The creation of an atmosphere of acceptance, understanding and respect is the most effective basis for facilitating learning. When the outcome of this approach to teaching is a person who is better informed and better able to guide himself intelligently, are not the realizations of the general goals of education evidenced: The development of persons who are self-disciplined, responsible citizens socially useful, capable of successful home and family life?

Home Economics teachers are employed with the expectancy that they are competent in home economics subject matter and that they understand and are able to work with the students. The teacher's degree of competency in subject matter is a dynamic ingredient in teaching and learning situations. Unless the teacher is competent, also, in the ability to release the capacity of the student to develop, the teaching and learning is half-done, if at all.

Both teacher and student have a great deal to learn as they work together. Each has, perhaps, different things to learn, but if teaching and learning are cooperative, then learning is necessary for each. Unless teachers understand the student, there's likely to be a great deal of "but I taught you" when the student really "never heard a word was said." Each teacher will operate within the framework of individual concept as to the role of the teacher in the learning process. The framework within which the teacher is capable of performing becomes the framework within which the students have an opportunity to perform.

With this belief we proceed to emphasize that at the teacher-level in any area of democratic instruction, the teacher (1) needs to identify own concept as to the role of the teacher in a democratic society, and (2) needs to identify own ability to assume the role of a democratic teacher, and (3) needs to understand the subject matter she is to teach, and (4) needs to understand how to lead students within the framework of student capacity toward achievement of desired goals. There is scarce need

to discuss cooperative evaluative procedures in instruction with teachers unless the preceding type of teacher beliefs is a part of the teachers philosophy.

General Procedures in Developing the Evaluation Program*

1. Formulating Objectives

Valid objectives are reached on the basis of considered judgement utilizing evidence regarding the demands of society, the characteristics of the students, the philosophy of education held and what we know as to the attainability of various types of objectives in specific subject matter areas.

2. Classification of Objectives

The types of objectives indicate the kinds of evaluation techniques essential to an adequate appraisal. Objectives classified in terms of competencies in general fields will require a different kind of appraisal technique than achievement of the objectives in a limited field of behavior. For example: Ability to plan adequate diets is a general competency expected as a result of instruction in nutrition and requires one kind of appraisal technique. Ability to identify foods sources of Vitamin A, a more limited intellectual ability, requires another appraisal technique. The more limited objective may be analagous to learning the multiplication tables in arithmetic. Just as the learning of the multiplication tables enables a person to go on to solve a variety of problems involving numbers, so does the learning of the relationship between food nutrients, sources of food nutrients, and function of food nutrients enable the student to go on to the solving of a variety of nutritional problems.

3. Defining Objectives in Terms of Behavioral Aspect and Subject Matter Content.

The type of behavior desired, such as an understanding or an ability, needs to be clearly stated. Some objectives are stated in terms so vague and nebulous that the kind of behavior they imply is not clear and are not, therefore, subject to adequate appraisal. As an example: "To develop the ability to relate the function of nutrients to food sources of nutrients." is amiable to adequate evaluation. Both behavior expected (ability to relate) and subject matter (function and sources of nutrients) are defined precisely.

4. Suggesting Situations in Which the Achievement of Objectives Will be Shown.

*Adapted from Unpublished paper. Cunningham, Pauline, Reed, Mary; Mackensen, Kathryn, "A Study of Evaluation Proecdures."

There should be a wide range of situations which might be used in evaluation; listing a considerable number of types of situations will give students a chance to indicate the sort of behavior patterns they have developed.

5. Selecting and Trying Promising Evaluation Methods

Some evaluation methods are misleading and upon examination and use will be found limited. Following the choice of test situations which hold promise of indicating evidence of the development of specific behaviors comes the responsibility of selection of the device to be used in the evaluation. Those which often seem to hold great promise may, upon use and examination, prove to be neither valid nor reliable in providing evidence of achievement toward defined objectives. Some will need to be discarded, others revised.

6. Developing and Improving Appraisal Methods

The basis for selecting devices depends on the degree to which the methods are found to give results consistent with other evidences regarding students attainment and the extent to which the methods are practicable and easily interpreted.

7. Interpreting Results

Procedures need to be used periodically in appraising the degree to which students are developing toward achievement of desired objectives. Some estimate of the degree of change or growth of students can be made. This analysis will serve as a basis for continued and further study and for interpreting the usefulness of the evaluative program.

Example of Procedures in Developing An Evaluation Program in Foods and Nutrition Which Follows the General Procedures.

General Procedures	Procedures in Food and Nutrition
1. <u>Formulating Objectives</u> A. <u>General Educational Objectives.</u>- such as developing a sense of responsibility, developing increased self direction, developing acceptable habits, develop an ability to work with other people - usually are considered to be important by the home economics teacher. They are not, however, unique to home economics. Evenso, any teacher who has not formulated general objectives will have difficulty in visualizing the contributions of home economics to the total development of the student.	Examples of formulating and classifying objectives on foods and nutrition which are consistent with objectives in general education. 1. Understandings. 1.1 Responsibilities and privileges as members of the family and of the community. 1.2 Cooperative vs. autocratic, competitive processes. 1.3 Value of self and others. 1.4 Value of available resources. 1.5 Developmental needs of young and old. 2. Attitudes 2.1 Willingness to accept responsibility. 2.2 Willingness to share work and rewards. 2.3 Willingness to use resources efficiently. 2.4 Willingness to care for property. 3. Abilities 3.1 To assess value of responsibilities which may be assumed. 3.2 To assume appropriate role in the group processes. 3.3 To use and care for resources. 4. Habits 4.1 Of discharging responsibilities assumed. 4.2 Of unselfishness. 4.3 Of conservation. 5. Judgements 5.1 In amount of responsibility to be assumed. 5.2 In choosing kinds of responsibility to assume. 5.3 In choice of methods of work.

General Procedures

Procedures in Food and Nutrition

B. Defining competencies in subject matter area -

It is useful in formulating objectives to first identify general competencies relevant to the instruction planned. Thus, in foods and nutrition courses, competencies in planning, providing, preparing and serving foods for adequate diets are of this class. They will not be restricted to any grade level necessarily.

C. Defining specific objectives in subject matter area.

When formulating this set of objectives, it is necessary to propose possible ways to evaluate achievement toward them. Criteria we outline below is not all-inclusive, but does define the characteristics which objectives must possess if they are to be subject to sound evaluation.

- (1) Be identified with the developmental level of those for whom the instruction is planned.

5.4 In use and care of resources.

6. Appreciation

- 6.1 Of value in assuming responsibilities.
- 6.2 Of value in cooperative work.
- 6.3 Of rights of others and of self.
- 6.4 Of resources available.

Examples of general competencies relevant to instruction in foods and nutrition.

A. Competency in planning meals for specific individuals and groups. Examples of objectives which may be relevant to the achievement of this competency are:

1. Interest in planning adequate diets.
2. Appreciation of the importance of adequate diets.
3. Knowledge of the body needs for food.
4. Knowledge of sources of nutrients.
5. Ability to plan meals satisfying to the senses.
6. Ability to plan adequate diets.

B. Competency in preparing meals. Examples of objectives which may be relevant to the achievement of this competency are:

- (1) Interest in principles and facts of food preparation.
- (2) Appreciation of the contribution of practices in food preparation to the nutritional opportunity of the family.
- (3) Understanding the effect of various food preparation practices on the retention or destruction of food nutrients.
- (4) Ability to choose recipes which do not violate important principles in conservation of nutrients.

General Procedures

Procedures in Food and Nutrition

- (2) Be defined as to the behavior desired and the subject matter involved. As an example in the following sample objective, "understanding" is the behavior desired, whereas "effect of boiling temperatures on the coagulation of egg protein" is the subject matter involved.

Sample objective: To understand the effect of boiling temperatures on the coagulation of egg protein.

- (3) Be within the possibility of achievement. At any one time and place not all equally important objectives may be achieved. Choices will be necessitated through limitations of time, space, equipment, students' readiness for the objective and other dynamic factors.
- (4) Be dynamic. That is, that they suggest action to be taken. This is of great importance. Evaluation is impossible unless pupils and teachers are able to choose several situations in which pupils may exercise the kind of behavior implied by the objective and use the subject matter involved.

- (5) Ability to apply principles and facts in food preparation processes.
- (6) Ability to use fuels and equipment efficiently.
- (7) Ability to prepare a variety of dishes which appeal aesthetically to others.

C. Competency in serving foods. Examples of objectives which may be relevant to the achievement of this competency are:

- (1) Interest in aesthetic arrangements for food service.
- (2) Appreciation of the relation of food service patterns to the cultural patterns.
- (3) Knowledge of various food service patterns which have arisen in various cultures.
- (4) Understanding that courtesy, convenience, orderliness, cleanliness are basic to satisfactory food service.
- (5) Ability to accept current food service patterns or else create new patterns suitable to time, place and equipment available.

D. Competency in Management.

1. In buying foods. Examples of objectives which may be relevant to the achievement of this competency are:

- 1.1 Interest in the nutritional value of the foods available.
- 1.2 Appreciation of the relationship of wise food purchasing practices to family welfare.
- 1.3 Knowledge of the nutrients provided in foods available on the market.
- 1.4 Ability to choose food which provide the greatest nutritional and aesthetic values at the price one can afford.
- 1.5 Ability to recognize information

D. Suggesting situations in which the achievement of objectives will be shown.

There should be a wide range of situations which might be

- helpful in wise shopping.
- 1.6 Ability to interpret information shown on labels and through other written devices.
 - 1.7 Ability to apply knowledge in choosing between food products.
 - 1.8 Habits of discretion in buying, such as habits of economy in using money, time and energy in satisfying family food needs.
2. In food conservation. Examples of objectives which may be relevant to the achievement of this competency are:
- 2.1 Interest in food conservation.
 - 2.2 Understanding facts and principles in food conservation.
 - 2.3 Appreciation of the relation of food conservation practices to nutritional opportunity.
 - 2.4 Ability to store foods in ways which preserve food value, flavors, textures and colors.
 - 2.5 Ability to use a variety of food preservation methods.
 - 2.6 Ability to design and arrange cabinets for economical storage of canned, dry and other less perishable foods.
 - 2.7 Ability to preserve foods by a variety of methods such as freezing and canning.
3. In the care and use of equipment. Examples of objectives which may be relevant to the achievement of this competency are:
- 3.1 Understanding facts and principles in care of equipment.
 - 3.2 Interest in the economical use of equipment.
 - 3.3 Ability to use equipment to save time, energy, and money for the family.

Example of the range in choice of situations in which the achievement of specific objective A6 above may be shown.

- A6. Ability to plan an adequate diet.
The situations are chosen in order

used in evaluation; listing a considerable number of types of situations providing opportunity for students to indicate the kind of behavior they have developed.

for the pupils to:

- (a) Plan an adequate diet for their own families.
- (b) Explain reasons for the plan they have made.
- (c) Relate nutritional conditions to causes.

Situations in which achievement might be shown:

- (1) Students given a description of a specific group of individuals and required to plan a diet for the group.
- (2) Students given a description of the nutritional condition of an individual or groups of individuals along with a copy of the diet of the people involved. Students required to explain why the nutritional condition exists.
- (3) Students given a description of specific individuals or group of individuals. Students required to set up a display of food models which would represent an adequate diet for this group or individual.
- (4) Students given a list of all the food on one school lunch tray for one person. Student required to analyze the specific nutritional contributions which the foods make to the total food needs for the day.

Value of identifying general competencies and specific objectives.

Once the general competencies and specific objectives for a course have been identified it becomes possible to develop evaluative devices to serve the three purposes of:

- (a) Determining the initial status of students with respect to their knowledge, interests, attitudes, habits and other behaviors included in the objectives,
- (b) Selecting by pupils and teachers learning activities that hold promise of effecting the desired changes in behavior; and (c) Constructing tests and other devices for the purpose of evaluating student progress.

PART II

TEST CONSTRUCTION

Part II of this booklet is written for the purpose of aiding the teacher to develop measuring instruments that may be utilized in evaluation procedures in the Foods and Nutrition area. Numerous examples of test items and testing devices are included. These test items and testing devices, if used blindly, will be of no value. They should be selected with discrimination to fit into rationally conceived evaluation procedures - that is, as means of obtaining evidences of attainment of the objectives for a Foods and Nutrition instructional program.

Characteristics of a Good Test.

A good test must have three qualities - validity, reliability and objectivity.

Validity - A test is said to be valid when it measures what it sets out to measure.

There are four aspects to validity.

- (1) The content aspect. A test is valid from a content standpoint if the test items or questions constitute an adequate sample of the subject matter indicated in a teacher's objectives for her class.
- (2) The discriminating aspect. A test is valid from a discriminating standpoint if it differentiates the students who possess what the test purports to measure from the students who do not possess what the test purports to measure. Thus, for a nutrition understandings test to be valid the students who possessed more nutrition understandings would obtain higher scores than the students who possessed less nutrition understandings.

Questions in a nutrition understandings test that could be answered successfully by all students usually would not contribute to the validity of a test from a discriminating standpoint. Similarly, questions that could not be answered successfully by any students would not contribute to the validity of a test.

- (3) The purpose aspect. The validity of a test must be considered in terms of the purpose of the test. A test may be valid for one purpose but not valid for another. Thus, a test may effectively rank students according to the amount of nutrition understandings they have but not be of much value in diagnosing students weaknesses.
- (4) The mental process aspect. For certain types of achievement tests it is appropriate to judge the validity of the test in terms of the mental processes through which students arrive at their answers.

to test items. For example, a teacher, who wishes to develop in her students an ability to apply principles to nutrition problems, may be more concerned in whether or not students arrive at answers to questions on a test through a process of applying principles (rather than just memorizing material) than in whether or not the student obtains the correct answer to the test question.

Reliability - a test is said to be reliable when it measures what it sets out to measure consistently.

The reliability of a test may be dependent upon the consistency of the behavior of the student that is measured by the test. Here the question raised is - "Is the sample of behavior of the student representative of other samples that could be secured at different time intervals?". This kind of reliability is usually estimated by correlating the scores obtained by students on one day on a test with scores obtained on the test on a second day. If the two sets of scores are positively highly correlated, then it is likely that the test is measuring a behavior that students appear to exhibit consistently from day to day. It can readily be seen that with some forms of behavior - for example, "aggressiveness" - we might need to sample various time intervals in order to obtain an adequate sample of the student's behavior.

The adequacy of the sample of test items within a test constitutes a second kind of reliability. Here the question raised is - "Is the sample of items on the test adequate to yield an accurate estimate of the student's status with respect to what is measured?". To a considerable extent this kind of test reliability is dependent upon the length of the test. If we include a sufficient number of valid test items that adequately sample the objectives to be measured we can obtain this second kind of reliability in a test.

Objectivity - A test is said to be objective when two or more competent judges can agree on what constitutes the correct answers for the test. In a perfectly objective test two teachers would arrive at identical scores in marking one student's test paper. Essay type examinations are frequently criticized because they lack this quality of objectivity. The objectivity of essay type examinations can be improved, however, if special care is taken in constructing and grading the test questions.

Constructing Tests on Nutrition Understandings.

There are a number of advantages in using objective test items¹ in testing students' nutrition understandings. One principal advantage is the economy in time in determining how much knowledge the student has. A second advantage is that, once the test has been constructed, the score of the student can be objectively determined. To attain these advantages, test items must be carefully constructed. A number of writers in the test construction field have listed rules for the construction of effective test items. Each stresses that a good test item must have the characteristics of a good test --- generally meaning that the test items should have validity, reliability, and objectivity and that the test item is directed

toward an important aspect of the subject tested. Each writer also stresses the need of stating a problem in the test item in such a way that the task which the testee is called upon to perform is clear. There are numerous types of objective test items --- the most common of which are the completion type, true-false items, multiple choice or best-answer items, and matching items.

1. Completion type items.

In a completion type item, the testee is given an incomplete statement with blanks left for the student to fill in. For example:

Oranges are rich in Vitamin_____.

The student would be expected to write C in the blank in this item.

In constructing this type of item it is important to keep the ratio of words given to words omitted very high because if too many words are omitted, the meaning of the whole will be obscure. The blanks should refer only to omitted key words - never to words such as "the", "a", "to", etc. In this type of item as in all others, the test constructor should avoid taking statements directly from textbooks but should rather concentrate on formulating the statement so clearly that the testee clearly sees the problem posed.

2. True-false items.

In a true-false item, the testee is given a statement and is required to indicate whether the statement is true or false. In constructing such items, statements that are broad generalizations should usually be avoided since such statements are practically always false. General statements that include such words as "never", "always", "sole", etc. should be avoided since many students will recognize them as false. Statements that include such words as "sometimes" and "some" are frequently recognized by students as true. In general, negative statements should be avoided, chiefly because they are often misread. In general, the test item should include only one idea.

The true-false test item is frequently criticized because a student has a 50 - 50 chance of obtaining the correct answer by guessing. Test constructors attempt to reduce this defect by including a large number of items on the test. One modification of the true-false item is to underline one or more key words in both the true and false items and require the student on all items he has marked false to revise the underlined portion of the statement in order to make the statement true. For example:

Liver is a rich source of calcium.

In this item, the student would be expected not only to mark the item false but also to cross out the word "calcium" and replace

it with the word "iron". Thus: F Liver is a rich source of ~~-calcium-~~ iron.

3. Multiple-choice or best-answer items.

In this type of test item a problem is posed and alternative answers to the problem (usually 3 to 5) are presented to the student. The student is required to select the best answer. For example:

What food is rich in calcium? (A) Beefsteak, (B) Milk, (C) Apple, (D) Eggs, (E) Carrots.

The problem posed is called the "lead" or "stem" of the item. The suggested answers are called alternates. Within the alternates usually only one response is made correct - the remaining incorrect responses are referred to as "distractors". In constructing multiple choice test items the stem of the item should pose a single central problem. The problem should contain only material relevant to its solution. The language used in stating a problem should be appropriate to the subject matter and understandable to the students to be tested. The distractors should be plausible answers rather than obvious distractors; that is, the distractors should present the kinds of errors that the student might make in coping with the problem posed.

In order to test the preciseness of the student's knowledge or understanding sometimes one of the distractors may be made partially true but not as good an answer as the correct response. Such distractors have been labeled "near misses" by Loree. Part credit is given to the testee for the "near miss" response. A number of test items in the appendix (keyed NM) are of this kind.

4. Matching test.

This test consists of a column of items, each of which is to be matched with the appropriate item in the second column.

The problem presented in a matching test is the same, really, as in a multiple choice test with the word or words in the first column serving as "stems" to test items and the word or words in the second column serving as the alternates for each item. In constructing this type of test, it is profitable to think each item through as a multiple choice test item in order to judge the appropriateness of the distractors in each item.

Constructing tests on the ability of students to solve nutrition problems.

Higher mental processes are usually involved in the student's effort to solve nutrition problems. Frequently the student requires some knowledge in order to solve the problem. But knowledge alone is not sufficient. Possibly the student is required to recognize what knowledge is

relevant to the problem. Possibly the student must be able to see the applicability of certain principles to the solution of the problem. Possibly the student will need to interpret data in arriving at a solution. Hence many objectives in foods and nutrition courses may be classified behaviorally as intellectual abilities and skills. Whether or not the student is able to solve many nutrition problems is often dependent upon whether or not he has developed the needed intellectual abilities and skills.

In developing test items designed to determine the ability of students to solve nutrition problems it is often economical to identify the intellectual abilities or skills that are of crucial importance in the problem solving process and concentrate our test items on these intellectual abilities and skills. Such items are deliberately designed not to measure the complete problem solving behavior in which we are interested. Because the test items developed do not test the complete behavior in which we are interested but only difficult aspects of the behavior, the mental process measured is referred to as an "index of behavior".

After an objective has been defined and situations in which the achievement of the objective might be shown by the student, the test constructor needs to think through the sub-problems involved in the achievement of the objective and focus test items on aspects of the objective that are appropriate for the students of her class. The following example is illustrative of the kind of analyses the test constructor must go through in constructing items designed to measure the problem solving abilities of students.

Objective - An ability to choose the foods to be bought for a family taking into consideration family income and health.

Analysis of objective - Certainly a student might demonstrate this ability if he were required to shop at the grocery store and purchase food for his own family for a number of weeks. In practice, however, it would be impossible for the home economics teacher to observe each student in the class making the food purchases over a period of weeks. It is necessary to find, therefore, certain sub-abilities that would be of crucial importance. Two sub-abilities that would be important in the attainment of the objective would be: (1) ability to recognize good sources of various food nutrients; and (2) ability to relate this knowledge to his knowledge of food costs.

Situation in which achievement of objective could be shown:

The student is given: A - a description of a family group with limited money to spend for food.
B - Names of three or more foods and one reason that could be the basis from a nutrition standpoint for choosing one of the named foods.

The student is required: To choose one of the named foods that will best meet the indicated nutrition purpose at the lowest cost.

Test items illustrative of situation outlined above:

A family composed of Mr. and Mrs. Brown, who are very active, and their three children (Carol, age 4; Paul, age 10; and Mary, age 16) has a very limited amount of money to spend for food, and must buy foods which give the greatest nutritive value for the dollar.

Imagine that Mrs. Brown is shopping in the summer.

DIRECTIONS: For each item, draw a line under the one food that is the best buy for the nutritional purpose listed for the item.

<u>Correct Answer</u> ¹	<u>Nutrition Purpose</u>	<u>Foods</u>
<u>A</u>	1. To get protein	(A) Young chicken, (B) hen, (C) frozen chicken pie.
<u>C</u>	2. To get Vitamin A.	(A) White squash, (B) onions, (C) Yellow squash.
<u>B</u>	3. To get Vitamin C.	(A) Bottled grape juice, (B) Frozen orange juice, (C) Fresh oranges
<u>B</u>	4. To get B Vitamins.	(A) Precooked rolls, (B) enriched bread, (C) white grits.
<u>B</u>	5. To get roughage.	(A) Cauliflower, (B) cabbage, (C) bananas.
<u>A</u>	6. To have a nourishing dessert.	(A) Dried apples, (B) apple pie from bakery, (C) frozen peaches.
<u>C</u>	7. To have milk to use for cooking	(A) Condensed milk, (B) fresh homogenized milk (c) dehydrated milk.
<u>B</u>	8. To satisfy body needs for energy.	(A) Milk, (B) pie, (C) lean steak.

Comments

Obviously, the actual foods and the nutritional purposes included in the above illustrative items are appropriate only if the students in a class have gained some knowledge of comparative costs of foods as well as a knowledge of good sources for various nutrients.

Note that in the above items, the reason why one food selection is better than another is not stated. An effort was made to construct each item in such a way that the student would need to think of the reason in order to arrive at the correct answer.

Following are the reasons for the best answers for each item:

1. Young chicken in season in summertime. Hen not in season; frozen chicken pie too expensive and less protein than whole chicken.
2. Yellow squash is best source of Vitamin A. White squash not as good source, onions less expensive but not a good source.
3. Frozen orange juice is best source. Grape juice not a good source, fresh oranges are out of season.

¹The correct answers are indicated for all test items included in this booklet for the convenience of the reader.

4. Enriched bread is least expensive and is a good source. Pre-cooked rolls are too expensive; white grits are not a good source.
5. Cabbage is best source. Cauliflower is expensive and does not furnish much cellulose; bananas do not furnish roughage.
6. Dried apples are nutritious and less expensive. Apple pie and peaches are too expensive.
7. Dehydrated milk is least expensive form for cooking. Condensed milk costs more and contains sugar, which is not a protective food, and fresh homogenized milk is more expensive.
8. The consumption of pie does yield energy. Hence pie is the correct answer when judging the relative merit of the three foods solely from an energy criteria.

Appendix A contains many other examples of test items that have been designed to measure the thinking ability and skills needed to solve problems in foods and nutrition.

Evaluation of Manipulative Skills

Often objectives involving the use of manipulative skills are evaluated in terms of desired qualities in a finished product. This is evidenced by the large number of food score cards used in home economics classes. In building a "food score card", the first step of the test constructor is to analyze the aspects of the finished product that are related to its "goodness". For an angel cake, for example, the following aspects may be identified: (1) appearance, (2) lightness, (3) tenderness, (4) moisture content, and (5) flavor. The second step of the test constructor is to describe in concrete terms what is meant by satisfactory "appearance" and what is meant by unsatisfactory "appearance"; what is meant by satisfactory "flavor", what is meant by unsatisfactory "flavor", etc. The third step is to incorporate the analysis undertaken in the first two steps into an evaluative device - in this case into a good score card for an angel cake. Following is an evaluative device that has been developed in the manner described above:

<u>Angel Cake</u>			Score
	1	3	
<u>Appearance (outside)</u>			
Crust	Sugary, sticky, cracked top	Uncracked and slightly rounded	_____
Color	Unevenly browned	Evenly browned	_____
<u>Appearance (inside)</u>			
Color	Uneven	Even throughout	_____
Texture	Coarse, tunnels	Small uniform cells	_____
<u>Lightness</u>	Heavy	Light	_____
Tenderness	Crust and crumb tough	Crust and crumb tender	_____

Angel Cake

	1	3	Score
<u>Moisture content</u>	Dry or soggy	Slightly moist	_____
<u>Flavor</u> (odor)	Unpleasant	Pleasant	_____
(taste)	Flat, too sweet, or poorly blended ingredients	Well-blended and character- istic of kind	_____
		SCORE	_____

The point of view taken by the writers is that evaluative instruments such as illustrated above are of most value when developed by the students of a class and made an integral part of the complete instructional process. The device above is based upon a "score card" developed by students and teacher prior to the manipulation of the ingredients to produce an Angel Cake. In this instance, the terms used in the device arose from words used by students in judging purchased angel cakes and one made by the teacher.

In many of the learning experiences provided in the foods laboratory, the student utilizes knowledge and intellectual ability as well as manipulative skills. Thus, in the food score card illustrated above, the score obtained by a student will depend upon the student's knowledge concerning the process of making the angel cake as well as his manipulative skills.

It is desirable to identify both the knowledge or intellectual ability objectives and the manipulative skill objectives in a foods laboratory learning experience. The appendix includes examples of test items designed to determine whether a student has the knowledge and intellectual abilities needed in food preparation processes. Usually the experienced home economics teacher will encounter little difficulty in identifying the purely manipulative skill aspects in a food preparation problem. In the preparation of the angel cake some crucial manipulative skills that might make a difference in the quality of the finished product are:

- (1) manipulation of measuring tools
- (2) complete separation of egg whites from egg yolks
- (3) gentleness in the folding process; and
- (4) removing the finished cake from the pan.

The identification of the crucial manipulative skills in a food preparation problem is the first step in constructing an evaluation device focused on the process (rather than the product) of food preparation. The second step is to describe in concrete terms what is meant by such terms as "satisfactory and unsatisfactory manipulation of measuring tools". These statements may be incorporated in either a check list or a rating scale. Obviously, in using such an evaluative device, the teacher will need to observe the student in the process of preparing a food.

Focusing attention on the process of preparing food rather than on the quality of the finished product often is profitable in identifying the next logical steps in the complete teaching process.

Evaluation of Interests

An "interest" may be defined as a liking for or a valuing of an activity. We usually assume that a person has an interest in an activity when he freely chooses to engage in the activity. Thus, when a person chooses to study nutrition rather than engage in some other activity, he is expressing an interest in nutrition. An interest may be intrinsic or extrinsic in nature. The interest is intrinsic when a person engages in an activity for the sheer joy of the activity. The interest is extrinsic when the person engages in an activity primarily because he sees the activity as a means of gaining some other end. Thus a person is expressing an intrinsic interest when he studies nutrition because he likes to study nutrition. He is expressing an extrinsic interest if he studies nutrition for some reason such as a desire to pass an examination.

Interests may serve both as ends and means in school; that is, both as objectives and as motivating factors related to the attainment of objectives.

To construct an evaluation device for interest objectives the test constructor needs to identify the variety of ways in which a person may express the desired interest. For the objective - "interest in principles and facts of food preparation" - the test constructor might list:

1. The student tries to gain more knowledge about the principles and facts of food preparation.
 - 1.1 He reads books and articles.
 - 1.2 He asks questions about food preparation both at home and at school.
 - 1.3 He attends clubs, views commercial programs from which he can gain knowledge about food preparation.
2. The student applies knowledge about the principles and facts of food preparation.
 - 2.1 He prepares foods in new ways in the home.
 - 2.2 He seeks new recipes.
 - 2.3 He carries on food projects in Home Economics, Agriculture or other clubs.

A similar list of concrete ways in which interests may be expressed should be made for all "interest" objectives in a foods and nutrition course. These ways may later be incorporated in one interest inventory. Such a list is useful in the teaching process in that it suggests kinds of activities the teacher will need to provide in order that students will have an opportunity to develop and express their interests.

The extent of the interest of the student in foods and nutrition

may be evaluated either in terms of (1) expressed preferences for foods and nutrition activities over other competency activities, (2) the degree of expressed liking for the activities identified, or (3) the frequency in the amount of time the student spends in the activities.

The first approach might call for the construction of a large number of items of the following type:

DIRECTIONS - For each of the following groups of three activities, place an M before the activity you like MOST; place an L before the activity you like LEAST.

- Item X. _____ 1. Learning how to prepare new foods.
 _____ 2. Learning how to write a business letter.
 _____ 3. Learning how to do a science experiment.

From a large number of such items, scores can be generated showing the relative interest in foods and nutrition over other competing interest areas.

An evaluative device constructed by Avice Graham¹ is illustrative of the second approach for determining the extent to which students are interested in nutrition. Twenty activities were identified as the concrete ways in which the student might express his interest. These were:

1. Helping mother in the kitchen.
2. Helping with the gardening.
3. Helping to buy groceries.
4. Helping to can, freeze or dry foods.
5. Carrying on a food project in Home Economics, Agriculture, or other club.
6. Trying new ways of preparing common foods.
7. Preparing foods following the general principles as learned in Home Economics.
8. Studying health habits in order to know how I can keep healthy.
9. Studying the requirements of an adequate diet.
10. Studying how some foods build our bodies and make us grow.
11. Learning which foods give us energy.
12. Studying why we need to eat foods rich in all vitamins and minerals.
13. Improving my own eating habits.
14. Helping to improve the eating habits of the members of my family.
15. Helping improve the eating habits of my friends.
16. Reading magazine articles on foods.
17. Helping to plan meals for my family.
18. Collecting recipes.
19. Experimenting on how a food will help the body or harm the body

¹Graham, Avice. "Investigation of the Validity of a Technique for Determining Interests in Nutrition". (Unpublished Thesis), Louisiana State University, Baton Rouge, La., 1950, pp. 101.

by feeding the food to white rats for a period of time and watching the results.

20. Keeping a daily food record in order to see whether or not I am eating an adequate diet.

For each activity identified, Graham formulated statements to enable students to indicate their extent of participation and enjoyment. The following is illustrative:

Activity 1: Helping mother in the kitchen.

Score

- 0 _____ a. I never help mother prepare a meal. That is not part of my work.
- 1 _____ b. Once in a while I help mother in the kitchen, if I cannot get out of it, but not more than an average of once a week.
- 2 _____ c. Mother will not let me help her in the kitchen.
- 2 _____ d. I do not have time to help mother in the kitchen.
- 3 _____ e. I help mother when I want her to do something for me.
- 3 _____ f. I help mother in the kitchen when one of my friends is coming to eat a meal with us.
- 4 _____ g. I help in the kitchen on the average of once a week and I like it after I get started.
- 5 _____ h. I help in the kitchen as often as I can because I like to work with food.

In the above item the student obtains an interest score of 5 by checking response "h", a score of 4 by checking response "g", etc. For each item students may obtain an interest score ranging from 0 to 5. Thus for the 20 items students may obtain scores ranging from 0 -- 100. It will be readily recognized that the validity of the technique described above is dependent upon: (1) the extent to which the activities selected represent an adequate sample of ways in which students might express an interest in foods and nutrition; (2) the defensibility of the scoring system used in order to evaluate the student's interest; (3) the willingness of the student to report accurately the extent to which he engages in the activity; and (4) the extent to which the student is able to analyze his own feelings of "likes" and "dislikes".

A third approach to the problem of evaluating the extent of students' interest in foods and nutrition involves determining the frequency or the amount of time the student engages in "foods and nutrition" activities. Again, the first step in this approach is building a list of the concrete ways in which the interests may be expressed. From the list of activities, the test constructor can then formulate a questionnaire to determine the number of times per week the student engages in the activity.

The use of any one of the three approaches outlined above may be used

by the teacher to determine whether or not students increase their interest in nutrition over a given time interval. For example, a teacher may determine the amount of time students engage in foods and nutrition activities at the beginning and at the end of grade eight. An increase in the amount of time spent, or the number of activities in which students participate or express their likes would constitute, in part, evidence of progress toward the interest objective. The teacher may also wish to examine changes in the nature of the activities of the student. Just as the teacher of English would wish to find students reading increasingly mature literature as well as just reading more literature, so the Home Economics teacher would wish to find an increase in the maturity level of the foods and nutrition activities engaged in by students. Thus in evaluating the extent to which foods and nutrition interest objectives are being achieved the teacher will need to keep in mind the maturity factor.

Two questions may be raised to obtain the information concerning students that will be of value as a means of motivating students:

1. What are the activities in foods and nutrition that the student likes?
2. What knowledge and skills does the student wish to have that he does not now possess?

Information derived from the first question may be of value to the teacher in relating classroom learning experiences to students' interest patterns. Information derived from the second question can be of even more importance as an aid in selecting learning experiences that are meaningful to both teacher and pupils. A word of caution is in order. Students' likes and felt needs should not constitute the sole basis for selecting learning experiences. When a person learning to drive a car does not feel the need for learning traffic regulations, the teacher is not relieved of responsibility for teaching this aspect of car driving. In such a case, the teacher's first problem is to lead the pupil to feel the need for learning traffic regulations. Similarly from the identification of the felt needs of students in the foods and nutrition area, the teacher may encounter problems of creating in the student a feeling of need as a first step in the learning process.

Following is an example of an evaluative device designed for the purposes of identifying the interests, felt needs and actual participation in foods and nutrition activities in a class of eighth grade girls:

Planning Our Learning Experiences

Below is a list of activities which we may engage in if we consider them of value. In Column I place an X in front of those activities which you like to do. In Column II place an X in front of those activities which you dislike to do. In Column III place an X in front of those activities which you would like to learn more about.

In the blanks to the right, place a check in the column which tells "how often" you already engage in each activity.

I Like to do	II Do not like to do	III - Would like to learn more about in school	Possible activities in Home Economics Class	Fre- quently	Some- times	Never
:	:	:	1. Help buy groceries for family	:	:	:
:	:	:	2. Help store and put away groceries when they are bought.	:	:	:
:	:	:	3. Help make salads	:	:	:
:	:	:	4. Make breadstuffs (e.g. biscuits, pancakes).	:	:	:
:	:	:	5. Make cocoa	:	:	:
:	:	:	6. Prepare oatmeal or other cooked cereal	:	:	:
:	:	:	7. Prepare fruits for breakfast	:	:	:
:	:	:	8. Prepare vegetables for meals	:	:	:
:	:	:	9. Prepare eggs for meals for family	:	:	:
:	:	:	10. Prepare snacks for special occasions	:	:	:
:	:	:	11. Prepare picnic meals	:	:	:
:	:	:	12. Pack picnic meals	:	:	:
:	:	:	13. Set the table	:	:	:
:	:	:	14. Know about good table manners.	:	:	:
:	:	:	15. Dry the dishes	:	:	:
:	:	:	16. Clean refrigerator	:	:	:
:	:	:	17. Care of the stove	:	:	:
:	:	:	18. Cook using printed recipes	:	:	:
:	:	:	19. Plan food for a Girl Scout week of camping	:	:	:
:	:	:	20. Cook "backyard" meals	:	:	:

Thus, through the identification of interests, felt needs and actual participation in foods and nutrition activities by students, teacher and students have established a base upon which to plan learning experiences. The teacher has discovered the "level" of the pupils' interests and felt needs and is able to plan to advance the maturity level of the students.

Evaluation of Attitudes

Numerous definitions of the word "attitude" may be found in the psychological literature. Central to most definitions is the concept of "a state of readiness" or "set". Thus one definition is - an attitude is a tendency to act in a certain way; this tendency may or may not be consummated.

The meaning of the term "attitudes" may be clarified by examining some of their dimensions. Thus -

- (1) The object of an attitude may be a thing, person, group, institution, activity, way of behaving or acting, concept, idea, or belief.
- (2) The direction of the attitude with respect to its object. may be one of acceptance or rejection.
- (3) The intensity of the emotional component of an attitude may vary.
- (4) Attitudes have intellectual bases.
- (5) Attitudes may be specific or general. A person may accept people from another country as "good workers" but not as "social equals" (specific attitude) or the person may accept people from another country in all respects as "equals" (general attitude).
- (6) Attitudes may vary in their consistency. Some attitudes may change from week to week - example - our attitude toward Mr. X. Other attitudes may be much more stable or consistent.
- (7) Attitudes may be public or private in nature. The attitude is public when we feel free to reveal it; private when we do not wish to reveal it.

In foods and nutrition classes home economists frequently wish to develop - (1) favorable or acceptance attitudes toward various foods or classes of foods; (2) acceptance attitudes or beliefs in the importance of applying nutritional standards in selecting and preparing foods. The teaching process is usually that of providing the nutrition information that would constitute an intellectual basis for the desired

attitudes.¹

In constructing an evaluative instrument to measure attitudes, the test constructor must first decide what dimensions of the attitudes are relevant to the objectives of the school - their direction (acceptance or rejection); their intensity; their intellectual bases; their consistency, etc. Secondly, the test constructor needs to identify the ways in which the attitude may be expressed. The kind of evaluative device that will emerge will be dependent upon the particular dimensions of the attitudes the test constructor wishes to measure and the test constructor's judgment as to the behavior of the student that can be considered as expressions of the attitudes.

The following is illustrative of an evaluation device in which the test constructor endeavors to determine the dimensions - direction, consistency, and bases - of attitudes toward a sampling of various basic seven foods.

¹Unfortunately, it is very difficult to change attitudes through a process of logical reasoning. Attitudes are most frequently formed through a process of "assimilation" or a process of "affective association". "Assimilation" is a process through which the child takes over the attitudes of his parents, his peers or his teacher. Affective association is a process through which the pleasantness or unpleasantness of a previous experience with an object (person, activity, idea, etc.) becomes associated with the object in future experiences.

Purpose of this evaluation procedure:

1. To determine the direction and consistency of attitudes toward foods representing each of the basic seven food groups.
2. To determine the base upon which the negative attitudes may have developed.

Given:

1. A list of phrases which may describe ways people feel about different foods.
2. A list of foods. (Column I)
3. A list of reasons for disliking foods. (Column IV, letter A through J)

Required:

First, tell how you feel about the food by placing the letter which represents how you feel about the food in Column II. Second, in Column III, place the letter which represents your reason for disliking the food. Points 1 - 2 and 3 are examples.

Letters: List of phrases which tell how people may feel about foods.

- O - Never tasted it
- X - Don't like it at all
- V - Like it very much
- F - Like it fairly well
- D - Don't know the food

Column I LIST OF FOODS	: Column II : Feelings	: Column III : Reasons	: Column IV - LIST OF REASONS FOR DISLIKING FOODS
Rutabaga	: 1. X	: D	: A - Sour, or Sweet, or Bitter
Chard	: 2. O	:	: B - Mushy, or Stringy, or Tough, or Smooth.
Sausage	: 3. V	:	:
Asparagus	: 4.	:	: C - Hot, or Cold
Beans, green	: 5.	:	: D - Smells funny
Broccoli	: 6.	:	: E - Taste it rest of the day, or makes one burp, or causes bad breath
	:	:	:
Celery	: 7.	:	:

Column I LIST OF FOODS	Column II	Column III	Column IV - LIST OF REASONS FOR DISLIKING FOODS
Collards	: 8.	:	: F - No food value, or dangerous at certain times, in cer- tain combinations.
Mustard greens:	9.	:	:
Cabbage	: 10.	:	: G.- Funny color
Turnip greens	: 11.	:	: H - Just don't like it
Spinach	: 12.	:	: I - Costs too much
Lettuce	: 13.	:	: J - For reason not listed
Okra	: 14.	:	: A - Sour, or Sweet, or Bitter
Peas, green	: 15.	:	: B - Mushy, or Stringy, or Tough, or Smooth.
Peppers, green:	16	:	:
Carrots	: 17.	:	: C - Hot, or Cold
Pumpkin	: 18.	:	: D - Smells funny
Squash, Yellow:	19.	:	: E - Taste it rest of the day, or makes one burp, or causes bad breath
Potatoes, sweet:	20.	:	:
Grapefruit	: 21.	:	: F - No food value, or dangerous at certain times, or in certain combinations
Lemonade	: 22.	:	:
Oranges	: 23.	:	: G - Funny color
Tomatoes	: 24.	:	: H - Just don't like it.
Strawberries	: 25.	:	: I - Costs too much
Onions	: 26.	:	: J - For reason not listed.
Corn	: 27.	:	:
Apples	: 28.	:	:
Bananas	: 29.	:	:
Peaches	: 30.	:	:
Pears	: 31.	:	:
Pineapple	: 32.	:	:
Prunes	: 33.	:	:
Milk, sweet	: 34.	:	:
Milk, evapora- ted	: 35.	:	:
Buttermilk	: 36.	:	:
Cheese, yellow:	37.	:	:
Beef	: 38.	:	:

Column I	Column II	Column III	Column IV - LIST OF REASONS
LIST OF FOODS	Feelings	Reasons	FOR DISLIKING FOODS
Pork	: 39.	:	:
Chicken	: 40.	:	:
Eggs	: 41.	:	:
Liver	: 42.	:	:
Fish	: 43.	:	: A - Sour, or Sweet, or Bitter
Shrimp	: 44.	:	: B - Mushy, or Stringy, or Tough, or Smooth
Peas, black- eyed	: 45.	:	: C - Hot, or Cold.
Beans, red	: 46.	:	: D - Smells funny
Beans, white	: 47.	:	: E - Taste it rest of the day, or makes one burp, or causes bad breath.
Soybeans	: 48.	:	:
Nuts	: 49.	:	: F - No food value, or dangerous at certain times, or in certain combinations
Bread, white	: 50.	:	:
Bread, whole wheat	: 51.	:	: G - Funny color.
Oatmeal	: 52.	:	: H - Just don't like it.
Rice	: 53.	:	: I - Costs too much.
Macaroni	: 54.	:	: J - For reason not listed.
Spaghetti	: 55.	:	:
Butter	: 56.	:	:
Oleo	: 57.	:	:

1. How many X's do you have in the numbers 4 through 20? _____
2. How many X's do you have in the numbers 21 through 25? _____
3. How many X's do you have in the numbers 26 through 33? _____
4. How many X's do you have in the numbers 34 through 37? _____
5. How many X's do you have in the numbers 38 through 49? _____
6. How many X's do you have in the numbers 50 through 55? _____
7. How many X's do you have in the numbers 56 and 57? _____

Are there any foods in your list marked X which you will not eat at home or at school, but would eat if you were visiting someone and they served it to you? _____.

If so, please list them below:

The above evaluative device might well be incorporated in an introduction to a unit on nutrition to aid the teacher and pupils in selecting goals that are appropriate to the pupils' needs. For instance, the items 4 through 20 represent the leafy - green and yellow vegetables; items 21 - 25, the ascorbic acid foods; items 26 - 33, other fruits; items 34 - 37, milk products; items 38 - 49, meats, poultry and other proteins; items 50 - 55, cereal products; and items 56 and 57, fats. After students have checked the likes and dislikes in each of these groups both they and the teacher have identified the direction and intensity of the attitude. If the direction is negative toward a large number of foods in a specific group, the attitude becomes of critical importance to the teacher. However, when one or two foods within a general class are the only ones disliked, then the attitude is not likely to be as important. When the direction is known, the choice of "kind of" learning experiences needed is facilitated.

The base of the attitude may also be revealed by the use of the above device (See Column III). If students dislike essential groups of foods for reasons listed in Column III, then learning experiences may be chosen which teach students how to remove the dislike for the foods. This use of an evaluative device was seen to be effective in teaching in one school. Students who disliked some foods very much chose to experiment with different recipes using the food with the aim of finding a way to prepare this important food so someone else will like it. Several students prepared these foods in ways that the FFA boys "raved" about. The girls who worked on this project actually ate some of the foods with the boy judges and were reluctant to low-rate the food (at least publicly). From this experience, the writers believe that exploratory evaluative devices toward "attitudes" hold value as motivational procedures when incorporated in the teaching - learning process. Home experiences reported as an outcome of this method showed some parent change in attitudes. As a specific example, one student reported that her father had said, "It's the first time I ever liked cauliflower."

It is indeed difficult to determine with certainty whether, during the course of instruction, students develop beliefs concerning the importance of following practices that are sound from a health and nutrition standpoint. The test constructor is confronted with the possibility that the public attitude of the student (what the student leads the teacher to believe he believes) may diverge from his private attitude (what he really believes). The task of developing a projective test in which the testee will unconsciously reveal his private attitudes is time consuming and requires considerable psychological insight and technical skill. Perhaps the use of anecdotal records provide a more practical means through which the teacher may evaluate changes in beliefs and values of the student.

In an anecdotal record the teacher makes a brief written description of an incident that he observes in the life of the student. The anecdote tells exactly what the child did or said, describes concretely the situation in which the behavior occurred and what other people did or said. It avoids evaluative or interpretive statements concerning the incident reported. An accumulation of such anecdotal records over a

period of time provide one basis for evaluating student development. In order to evaluate students' beliefs concerning the importance of following practices that are sound from a health and nutrition standpoint, the teacher would record all incidents that would appear relevant to students' beliefs and values concerning nutrition and health.

A work of caution is in order. The foregoing description of the use of anecdotal records as a means of evaluating changes in beliefs and values of the students requires considerable skill and psychological insight on the part of the teacher. Teachers who wish to add to their repertoires of teaching skills, an ability to use anecdotal records effectively, may profitably study a text such as "Helping Teachers Understand Children",¹

Evaluation of Food Habits

For many teachers of nutrition in the elementary and secondary school, the improvement of food habits is the most important instructional objective in nutrition education. Certainly a fine instructional job has been performed when the improvement of the food habits of the child represents a deliberate attempt on the part of the child to utilize his understandings in nutrition in order to maintain or improve his health.

The seven-day food record is a method frequently used to evaluate the food intake of students. Appendix B contains a copy of the food record form that has been used in research at the Louisiana State University Agricultural Experiment Station. The student is given one form for each of the seven days and asked to record each food that he consumes over a period of a week. It is necessary to explain the form carefully to students at the beginning of the week in which the record is to be kept and instruct students to jot down what they eat immediately after each meal. It is highly desirable to provide a few minutes classroom time each day to allow students to fill in or check their forms. At the end of the week the filled in forms may be scored in terms of servings of protective foods. A maximum of 17 points could be earned by a student for one day by allotting one point per serving for each of the following:

<u>Food</u>	<u>Servings</u>	<u>Food</u>	<u>Servings</u>
Green leafy vegetables	1	Milk	4
Whole grain cereal or bread	3	Egg	1
Butter or fortified margarine	3	Fruit (non-citrus)	1
Potato (Irish or Sweet)	1	Fruit (citrus)	1
Other vegetables	1	Meat	1

¹Prescott, Daniel A., and Staff of the Divisions on Child Development and Teacher Personnel, American Council on Education, Washington, D. C., 1945.

The use of the seven-day food record may be of value in a number of ways. It provides a means through which students can evaluate their own diets. It can serve to identify general deficiencies in the diets of a class as a whole and thus provide a direction for further instruction. It can, when administered on successive years provide a basis for determining whether or not students' food habits are improving. To use food habit records for this latter purpose, it is necessary to make certain that the conditions under which the records are administered are similar - i.e., given to the same students, instructions identical, given at the same season of the year, etc.

The food habits of the young often depend on the food habits at home. The kinds of foods purchased, grown, prepared and served; the attitudes of other family members toward specific foods often form the base of the students habits. For this reason, in the opinion of the writers the food habit record may best serve the purposes of the school when combined with the evaluation of other forms of student development. Food habit records may provide evidence that students improve the quality of their food intake. An important question that remains to be raised is "Why has the student improved?" In an authoritarian classroom, the change may merely represent a conformity (real or faked) to the expectancies of the teacher. If, on the other hand, as a result of instruction within a democratic classroom, the student deliberately corrects his faulty food habits on the basis of increased understandings in nutrition and as a means of maintaining or improving his health - then the change of food habits may represent an important development in the student to direct his own life in a mature manner.

APPENDIX A

TEST ITEMS - KNOWLEDGE AND INTELLECTUAL ABILITIES

The test items included in this section of the booklet are classified under the four competencies listed on pages 24 -- 28. The classification is arbitrary. Many test items, classified under one competency, are directed toward objectives that are relevant to other competencies.

A. Planning Nutritious Meals

Basic to the development of this competency is the development of understandings of the relationship between:

1. Sources of food nutrients (foods such as oranges, meat, bread).
2. Food nutrients (such as Vitamin C, protein, carbohydrates).
3. Functions (such as supplying energy, building muscles).

Six types of problems can be generated to test the students' understandings between the three classes of information.

Type 1 - GIVEN: (1) ~~SOURCE~~ (a food).
(2) Food NUTRIENTS.

REQUIRED: To select the food nutrient in which the given food is a good source.

EXAMPLES:

1. Fortified oleomargarine is a good source of:
 - A. Carbohydrate and Vitamin C.
 - B. Carbohydrate and protein.
 - C. Fat and iron.
 - X D. Fat and Vitamin A.
 - E. Protein and thiamine (Vitamin B₁).
2. A daily serving of citrus fruit is recommended because:
 - A. Citrus fruits prevent colds.
 - B. Citrus fruits promote the flow of digestive juices.
 - X C. Citrus fruits are an excellent source of ascorbic acid (Vitamin C).
 - D. Citrus fruits are one of the inexpensive foods.
 - E. Citrus fruits are good sources of Vitamin A.
3. Fish help to supply the needed amounts of:
 - X A. Iodine

- B. Carbohydrates
 - C. Ascorbic acid (Vitamin C).
 - D. Iron
 - E. Cellulose.
4. Carrots are considered a very good source of:
- A. Complete protein
 - B. Ascorbic acid (Vitamin C).
 - C. Thiamine (Vitamin B₁).
 - D. Fat
 - X E. Vitamin A in the form of carotene.
5. Cooked turnip greens supply in a form the body can utilize, large quantities of:
- A. Fat
 - X B. Iron, Vitamin A, ascorbic acid (Vitamin C)
 - C. Phosphorus, thiamine (Vitamin B₁), riboflavin (Vitamin B₂)
 - D. Incomplete protein.
 - E. Carbohydrate
6. Molasses is principally a carbohydrate food but it does supply considerable amounts of:
- A. Protein
 - B. Calcium
 - X C. Iron
 - D. Ascorbic acid (Vitamin C)
 - E. Vitamin A
7. Whole milk is considered an excellent source of:
- A. Vitamin K
 - X B. Vitamin A
 - C. Ascorbic Acid (Vitamin C)
 - D. Vitamin E
 - E. Thiamine (Vitamin B₁)
8. Buttermilk is a rich source of:
- A. Fat
 - B. Ascorbic acid (Vitamin C)
 - C. Thiamine (Vitamin B₁)
 - X D. Riboflavin (Vitamin B₂)
 - E. Vitamin A
9. Cornflakes are primarily a good source of:
- X A. Carbohydrates
 - B. Complete protein
 - C. Vitamin A
 - D. Thiamine (Vitamin B₁)
 - E. Ascorbic acid (Vitamin C)

10. Strained green leafy vegetables are added to the infant's diet of milk to supplement his supply of:

- A. Ascorbic acid (Vitamin C)
- B. Fat
- C. Vitamin D
- X D. Iron
- E. Carbohydrate

Type 2 --GIVEN: (1) SOURCE (a food)
(2) FUNCTIONS

REQUIRED: To select the function served by the given food

EXAMPLES:

1. The body uses the food nutrients supplied by eggs:

- A. To supply fuel
- X B. To build and maintain blood, muscle, and bone.
- C. To prevent goiter
- D. To prevent scurvy

2. Cheese and meat are used interchangeably as main dishes in meals because:

- A. They are both animal products
- X B. Each contains bodybuilding substances
- C. It is desirable to provide variety in the diet
- D. Both foods are nutritious
- E. Both foods are excellent sources of Vitamin C

3. The lean meat in the diet supplies certain nutrients which the body uses to:

- A. Supply fuel
- X B. Build body tissue
- C. Prevent scurvy
- D. Build up reserve supplies of Vitamin D
- E. Promote muscular activity of the digestive tract

Type 3 - GIVEN: (1) Food NUTRIENT
(2) SOURCES (foods)

REQUIRED: To select the best source for the given food nutrient.

EXAMPLES:

1. Vitamin C is found in abundance in:
 - A. Most fruits and vegetables
 - X B. Citrus fruits
 - C. Milk and milk products
 - D. Most meats
2. Foods richest in iron are:
 - A. Legume vegetables
 - B. Breadstuffs
 - X C. Liver and lean meat
 - D. Carrots and leafy vegetables
3. The best source of Vitamin A among the following foods is:
 - A. Meat and poultry
 - B. Tomatoes
 - C. Starchy vegetables
 - X D. Carrots
4. An average serving of which of the following foods would be the richest source of riboflavin (Vitamin B₂)
 - A. Milk (1 glass)
 - B. White potato (1 medium)
 - X C. Liver (1 slice)
 - D. Bacon (2 slices)
 - E. Oranges (1 medium)

Type 4 - GIVEN: (1) Food NUTRIENT
 (2) FUNCTIONS

REQUIRED: To select the food nutrient that serve the given function

EXAMPLES:

1. Which mineral is needed by the body to make strong bones and teeth?
 - A. Iodine
 - X B. Calcium
 - C. Carbon
 - D. Iron
 - E. Sulphur

2. A small amount of what food substance supplies the body with a large amount of heat and energy?
- A. Carbohydrates
 - B. Proteins
 - X C. Fats
 - D. Roughage
 - E. Minerals
3. This mineral is needed for the blood. It helps the blood to carry oxygen to the lungs.
- A. Iodine
 - B. Calcium
 - C. Carbon
 - X D. Iron
 - E. Sulphur
4. Which one of the following kind of food substance is needed in building muscles in the body?
- A. Carbohydrates
 - X B. Proteins
 - C. Fats
 - D. Water
 - E. Minerals
5. Which one of the following food substances more quickly furnishes the body with heat and energy?
- X A. Carbohydrates
 - B. Proteins
 - C. Roughage
 - D. Minerals
 - E. Vitamins
6. Sore and bleeding gums may be caused by a lack of foods containing:
- A. Protein
 - B. Iron
 - C. Calcium
 - D. Vitamin B₁
 - X E. Vitamin C
7. Why is it necessary to eat a certain amount of roughage each day?

- A. It supplies the body with heat and energy
 - B. It is a body builder
 - X C. It promotes a bowel movement every day
 - D. It is needed to form red blood cells
 - E. It keeps the eyes healthy.
8. Growth if held back and certain eye defects may be caused by a lack of foods containing:
- X A. Vitamin A
 - B. Carbohydrates
 - C. Vitamin C
 - D. Iron
 - E. Calcium
9. Rickets and poorly formed bones in the body may be caused by a lack of what vitamin?
- A. Vitamin A
 - B. Vitamin B
 - C. Vitamin C
 - X D. Vitamin D
 - E. Vitamin G

Type 6 - GIVEN: (1) FUNCTION
(2) SOURCES (foods)

REQUIRED: To select the food that will serve the given function

EXAMPLES:

1. Which food has a large amount of two of the food substances needed by the body to make strong bones and teeth?
 - X A. Milk
 - B. Oranges
 - C. Bread
 - D. Meat
 - E. Butter
2. Which is the food that is sometimes called the perfect food? It is rich in minerals and vitamins. It supplies us with energy and helps us grow.
 - X A. Milk
 - B. Bread
 - C. Meat
 - D. Eggs
 - E. Spinach

3. Which food supplies the body with a food substance needed for the red cells of the blood?
 - A. Butter
 - B. Oranges
 - X C. Liver
 - D. Beets
 - E. Celery

4. Which food is the cheapest to buy for energy?
 - A. Green vegetables
 - X B. Bread
 - C. Fruits
 - D. Lean meat
 - E. Eggs

5. A small amount of this food supplies a large amount of heat and energy to the body.
 - A. Milk
 - B. Spinach
 - X C. Butter
 - D. Orange
 - E. Lean meat

The following problem situation, developed by Mrs. Kathryn Mackensen for use in the Louisiana State University Laboratory School, is illustrative of:

- (1) Test items in which the student is required to apply a knowledge of sources of food nutrients in planning diets for specific individuals and groups.
- (2) The subsequent application of the principles included in the test items to the solution of the individual student's concerns in the nutrition area.

A TYPICAL AMERICAN FAMILY

THE SMITHS

Mr. Smith, the daddy is 40 years old. He works as a carpenter and is very active.

Mrs. Smith, the mother, is 36. She does all her own house work. She plans, prepares, and serves her family meals.

Jane Smith, is 14 years old and is in the eighth grade. She is very active in the high school sports and also helps her mother with the house work.

Bob Smith, is 10 years old and is in the fourth grade. He is also very active in sports. He keeps the lawn mowed and the yard clean. Bob is just recovering from the measles.

Jack Smith, is 3 years old. He is a "run-about". He is growing rapidly just like Jane and Bob.

Mrs. Smith is often distressed because the children suffer from faulty elimination, which shows up in the condition of Jane's skin and Bob's disposition.

In Home Economics Jane had learned that the body requires specific nutrients each day to stay healthy and happy. Jane brought home a list of the types of foods essential for the day's diet for one person. She and her mother replanned this list to satisfy the daily needs of the Smith family.

Below there are two lists labeled I and II. I is the list of foods Jane and her mother made for their family's daily needs. Number II is a list of the reasons why they included these foods. Match the foods in I with the ones which best satisfy the reason in II. Write your answer in the blanks on the left side of II. The number of blanks indicates the number of best answers.

LIST I. Foods Jane and her mother listed as essential for their family's daily needs.

1. Four quarts of milk
2. Three vegetables, including one raw, one green leafy and one starchy (more of the starchy vegetable for the father).
3. Two fruits, including one citrus fruit
4. One egg dish
5. One meat or fish dish
6. Two servings of whole grain cereals
7. Butter (or enriched oleo) as desired
8. One serving of dessert
9. Seven or more glasses of water each day per member
10. Some soft and easily digested foods

LIST II. Reasons for foods listed as essentials for the Smith family

Reasons based on individual needs of each member of the family

10 For Bob who is convalescent and for Jack who needs foods that are easily digested

1 Two adults and three children

2 3, 6, 9 To combat faulty elimination

2 7 To supply the father with extra energy foods

Reasons based on general nutrition needs of any human being

- 2 To supply Vitamins A, B, C, Carbohydrates, Iron, and Cellulose
- 3 To supply Vitamin C and to stimulate appetite.
- 1 To supply calcium, phosphorus, some iron, and vitamins
- 6 To supply carbohydrates for energy and Vitamin B₁
- 7 To supply Vitamin A and energy and to add flavor to certain foods.
- 5 To supply complete protein and iron
- 6 To supply extra energy foods and add finishing touches to the meal

Following the administration of the foregoing test the students were asked to give data relative to the nutritional needs of their own family and to plan diets to satisfy these needs. The following was used to aid the student in focusing on the important considerations.

MY FAMILY

III. Data concerning My Family which will help me plan nutritious menus

Members of My Family	: Age of Each Child	: State of Health	: Occupation	: Other data
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:

- IV. (a) Make a list of the foods your family needs daily to be adequately fed. : (b) In terms of nutrients contained in the foods, explain your reason for putting each food into your list.
- FOODS (State the amount for number of servings. :

The performance of the students in the above activity provided evidence to both students and teacher of the nature of the next appropriate learning experiences.

The following set of items were designed to test the student's ability to evaluate menus in terms of color, cost, preparation time, use of cooking fuel, and suitability for small children.

Jane helped her mother to plan some menus for dinner. Below are the menus which they considered. You are to judge each as to color, cost, preparation time, suitability for small children, and use of cooking fuel.

No. 1

Hamburger Steaks
Mashed Potatoes Buttered Cabbage
Enriched Bread and Margarine
Grapefruit and Orange salad
Vanilla Pudding
Milk

No. 2

Smothered Round Steak with Onions
Baked Potatoes Creamed Cauliflower
Whole Wheat Rolls and Butter
Perfection Salad (shredded
cabbage and pimiento in
gelatin)
Quick Mix Chocolate Cake
Milk

No. 3

Fried Ham with Gravy
Buttered Frozen Corn Asparagus Tips
Hot Rolls and Butter
Peach and Cottage Cheese Salad
Frozen Strawberries and Whipped Cream
Milk

Place the number of the menu in the blank beside the words which best describe the characteristics of the menu.

- | | |
|---|--|
| 3 <u> </u> A. Most colorful | 1 <u> </u> F. Takes least time to prepare |
| 1 <u> </u> B. Least colorful | 1 <u> </u> G. Better for small children |
| 3 <u> </u> C. Most expensive | 2 <u> </u> H. Uses most cooking fuel |
| 1 <u> </u> D. Least expensive | 3 <u> </u> I. Uses least cooking fuel |
| 2 <u> </u> E. Takes most time to prepare | |

The following problem situation is designed to test the ability of the student to plan special occasion meals.

Meal Planning:

OBJECTIVE: Ability to plan special occasion meals

- GIVEN: (1) A situation in which characteristics of one type of special occasion meal are described.
(2) A list of various foods to be used in planning various parts of the meal.

REQUIRED: To select the food in each part of the menu which will best meet the characteristics desired

Situation: Jane has invited five girls and six boys to a buffet supper after a game in January. Jane plans to attend the game with her friends. She wishes to have an attractive, well--balanced meal at moderate cost and to have one with little last minute preparation. Her mother will be home during the evening but Jane does not want to have her kept busy in the kitchen.

Directions: In the blank to the left, place the letter which represents the food which will best meet the characteristics desired.

C 1. Main dish

A. Individual broiled steaks

- B. Macaroni and cheese casserole
- C. Casserole of creamed chicken
- D. Baked fish

D 2. Salad

- A. Mixed fresh fruit (apples, oranges, grapefruit).
- B. Molded shapes of gelatin salad (grated carrots, apples, celery).
- C. Stuffed egg salad.
- D. Mixed fresh vegetables (lettuce, carrot sticks, celery, radishes).

D 3. Bread

- A. Crisp corn sticks
- B. Variety of dainty sandwiches
- C. Hot cheese toast
- D. Hot rolls (bought at bakery).

B 4. Dessert

- A. Pineapple ice-box cake with whipped evaporated milk
- B. Vanilla ice cream with fudge sauce and sugar cookies
- C. Variety of fresh raw fruits (apples, grapes, and oranges)
- D. Hot peach pie with hard sauce.

Give your reasons for your choice of food and your reasons for rejecting the other foods in each of the dishes. Explain why you chose:

1. The main dish
2. The salad
3. The bread
4. The dessert

Example of kind of response expected from student in explaining their choices:

1. Main dish
 - a. Steaks eliminated on basis of cost and preparation schedule
 - b. Macaroni and cheese casseroles deteriorate in texture when held over a time and are re-heated.
 - c. Casserole of creamed chicken may be prepared earlier and held without deterioration for several hours.
 - d. Baked fish may be expensive, and less palatable when held for several hours before serving.

The form of the above test items is worthy of note. The first part of the test exercise -- i.e., the four multiple choice items -- serves the purpose of providing the setting for a well-focused essay question.

B. Food Preparation

Examples of tests designed to evaluate understandings, intellectual abilities in food preparation.

One General Objective: Understanding effect of physical and chemical actions on the nutritional and aesthetic qualities of the ready-to-serve food product. Achievement of this general objective may be evaluated through evaluation of achievement of specific objectives.

I. Specific Objective: To judge the nutritional value of foods prepared by various methods.

GIVEN: Descriptions of methods which may be used in preparing specific foods.

REQUIRED: To choose the method which preserves the most food value. Place an (X) in the blank to the right of the best choice.

A. Which cole slaw salad would have the highest food value? The salad made of:

1. Green cabbage ground in a meat chopper an hour before serving time and held at room temperature.
- X 2. Green cabbage shredded with a knife, seasoned, and served immediately.
3. White cabbage shredded an hour before serving time and stored in the refrigerator.
4. White cabbage grated and placed on the serving table thirty minutes before serving time.
- NM 5. Green cabbage shredded an hour before serving time and stored in the refrigerator until serving time.

B. Which method of cooking dried peas and beans would preserve the greatest nutritive value?

1. Add soda, cook without soaking in enough water to cover until tender.
- NM 2. Soak overnight, drain off water in which beans were soaked, add fresh water, season, cook until tender.
3. Cook in deep fat.
- X 4. Soak in warm water for four hours. Season and cook in water in which beans have been soaking until tender.
5. Soak overnight in water to which soda has been added, drain off water, add fresh water, season, cook until tender.

C. When cooking frozen lima beans, to save nutrients:

1. Thaw out the vegetable before cooking.
- X¹ 2. Place them in boiling water without thawing.
- NM¹ 3. Place frozen beans in cold water, then boil.
4. Add soda while cooking to get them soft in as short a time as possible.

D. Which of the following methods will preserve the greatest nutritive value of cabbage?

- NM 1. Cook in a large amount of water in an uncovered vessel.
2. Boil, drain off water, and add more water then continue cooking at low temperature.
- X 3. Boil in an uncovered vessel until tender.
4. Season with salt pork, add a small quantity of water, cover, and cook slowly until pork is thoroughly done.
5. Boil in a large amount of water until the leaves are wilted well, pour off water, and simmer in a pan for one hour.

E. Which of the following procedures in making vegetable salads is the best to use in order to preserve the maximum nutrients?

- X 1. Use as soon as possible after they have been harvested.
- NM 2. Wash and store in towels or covered containers in the refrigerator.
3. Soak in ice water before serving.
4. Marinate vegetables in salad dressing as soon as possible.

II. Specific Objective: To understand the effect of food preparation processes on the aesthetic qualities of the ready-to-serve food.

GIVEN: Description of food preparation processes which may affect the palatability of ready -to-eat products.

REQUIRED: To choose the process which will produce the most palatable food. Place an (X) in the blank to the right of the best choice.

A. To obtain the most palatable product in preparing

¹NM represents a Near Miss -- a response that is a fairly good answer but not as good as the correct response. See page 32.

a prime rib roast with least loss of juices:

1. Cook in a hot oven for entire cooking time (435 degrees).
2. Sear it in a very hot oven (450 degrees) until brown, then finish cooking at 150 degrees.
- X 3. Cook in a slow oven (300-325°) for the entire cooking period.
4. Cook in Dutch oven on top of the stove at boiling temperature.
- NM 5. Sear it on top of stove and cook in a moderate oven (350°).

B. To make smooth chocolate fudge or icing, always:

1. Beat the mixture slowly until it hardens.
- X 2. Wait until the mixture cools before beating.
3. Add a few drops of water all during the cooking.
- NM 4. Scrape the sides of the pan during cooking

G. Which two of the following procedures for making white sauce will each produce a smooth sauce?

1. Stir the flour into the heated milk and then add the butter.
- X 2. Melt the butter, add the flour then add the milk gradually and cook until thick.
3. Add the flour directly to the hot liquid.
4. Stir the flour into a small amount of cold milk, add the rest of the milk to the mixture, cook for 5 minutes after it comes to the boiling point, then add the butter.
- X 5. Mix flour into 1/4 of the cold milk. Add remainder of the milk to the mixture; cook, stirring constantly, until mixture thickens. Add butter.

D. In order to prevent quick-cooking rolled oats from becoming mushy, the best method to use is:

1. Wash, as rice, before stirring into boiling, salted water.
2. Cook in a large amount of water, drain then pour cold water over it.
- X 3. Cook in salted, boiling water, stirring frequently, for several minutes, reduce flame and continue cooking process until cereal is done.
- NM 4. Pour cereal into salted, boiling water and stir continuously over direct flame until cereal is done.

E. In order to make an apple pie with crisp, tender crust the most important thing to do is:

1. Knead the pastry dough to develop the gluten.
2. Remove the peelings from the apples.
- X 3. Stop the addition of moisture to pastry mixture whenever the fat and flour particles have blended enough to hold together in one mass.
- NM 4. Always add the exact amount of fat called for in the recipe for the pastry.

F. Which of the following procedures in making vegetable salads is the best to use to produce a crisp salad?

1. Using the vegetable as soon as it comes from the market.
- X 2. Washing and storing fresh vegetables in towels or a covered container in the refrigerator.
- NM 3. Soaking the fresh vegetables in cold water before using them in a salad.
4. Marinating vegetables in salad dressing.

III. Specific Objective: To be able to relate cause and result in food preparation.

GIVEN: Either a result or a cause in food preparation.

REQUIRED: To relate cause to effect.

A. What is the most undesirable change which will take place when a four pound loin roast is baked at 450° F. for two hours?

1. The roast will become rare.
2. The roast will become very tender.
- X 3. The roast will loose an appreciable amount of juice.
4. The heat will seal in the juices.
- NM 5. The roast will weigh more raw than cooked.

B. The crust of the butter cake which Mary made in class was peaked, cracked, and lacked uniformity in shape. What is the most likely cause of these factors?

1. Using general purpose flour.
2. Using too much sugar.
3. Using too low a temperature in baking.
- X 4. Using too high temperature in the first of the baking period.
5. Using a poor size pan for the amount of batter.
- NM 6. Using too high temperature throughout the baking period.

C. The butter cake that Edith made fell in the center and was heavy. It was irregular in shape. These faults are likely to be caused by:

1. Substituting an equal amount of another kind of fat for the butter.
2. Having uneven heat in the oven.
- X 3. Using too much sugar
4. Using too little baking powder.
- NM 5. Measuring the sugar inaccurately.

D. Which of the following procedures is most likely to prevent yeast rolls from rising?

1. Using too much shortening in relation to liquid.
- X 2. Using liquids at temperature above 98° F. in the mixing process.
- NM 3. Using more salt than specified by the recipe.
4. Using the wrong kind of baking powder.

E. Yeast is able to act as a leavening agent in flour mixtures because:

1. It is a one-celled plant.
2. It reproduces by budding.
3. It requires food and warmth for growth.
- X 4. It liberates carbon dioxide as it grows.
- NM 5. It requires starches and sugars for its growth.

F. In baked breads, the leavening agent used is most likely to determine:

- X 1. Lightness in weight of the bread
2. Lightness in color of the bread.
3. Crispness in the bread
4. Toughness in the bread.
- NM 5. Size of cells in the bread.

G. Which of the following leavens is most responsible for the leavening of popovers?

1. Carbon dioxide.
- NM 2. Air.
- X 3. Steam.

H. Eggs are used in many recipes for various reasons. What is the principle reason for using eggs in making croquettes?

1. They add food value.
- X 2. They act as a binding agent.
- NM 3. They leaven the food used in the croquettes.
4. They are usually available.

General Objective: Understanding terms often used in food preparation.

Specific Objective: To be able to recognize definition of food preparation terms.

GIVEN: A list of terms often used in food preparation (Column II).
A list of definitions of various terms often used in food preparation (Column I).

REQUIRED: Match the term to the best definition of that term.
Definition A, below, is an example to show how to write your answers. Four has been placed in the answer space because definition A is a definition of (4), braise.

Column I

Part I. Definitions --

- 4 A. To brown meat in a hot pan in a small amount of fat, add liquid (or cook in its own juices), cover closely and cook slowly.
- 6 B. To boil for a short time before cooking by another method.
- 1 C. To cook in water which is barely bubbling.
- 5 D. To cook by direct heat from hot coals, a gas flame, or electric element.
- 2 E. To cook in water which is bubbling rapidly.
- 3 F. To cook uncovered in the oven.

Part II. Definitions -

- 4 A. To combine fat and sugar, mixing well until light and fluffy.
- 3 B. To mix dough with hands.
- 1 C. To combine fat with dry ingredients with a pastry blender or two knives.
- 2 D. A method of combining ingredients with egg whites to incorporate air.

Part III. Definitions

- 1 A. Allowing food to stand in a brine, vinegar or liquid until well saturated.
- 2 B. French word meaning to panfry in small amount of fat.
- 3 C. To cook until tender and serve with gravy made from stock.
- 5 D. To remove fruit or vegetable skins without a knife.
- 4 E. To remove fruit or vegetable skins with a knife.

Column II

Part I. Terms -

- (1) Simmer
(2) Boil
(3) Roast
(4) Braise
(5) Broil
(6) Parboil

Part II. Terms -

- (1) Cut in
(2) Fold
(3) Knead
(4) Cream

Part III. Terms --

- (1) Marinate
(2) Saute
(3) Fricassee
(4) Pare
(5) Peel

C. Serving

- I. Specific Objective: Ability to judge materials and containers for use as centerpieces for informal meals.

GIVEN: A series of descriptions of containers and materials which may be used for centerpieces at meals.

REQUIRED: Choose one series (A, B, C or D) which offers the best suggestions for centerpiece arrangements. Place a (O) zero, in the blank to the left of each series you reject, and place an X (X-mark) in the blank to the left of the best choice.

- O A. A long stem rose, zinnias in a tall vase, or gladiolas.
 X B. A bowl of ivy, an arrangement of fruit, or baby zinnias in a low bowl.
 O C. A low bowl of marigolds, a floating arrangement of cape jasmines, or a bowl of pinks.
 O D. An arrangement of evergreens around tall tapering candles.

In Column I below, circle the letters which you marked with a O (zero) above. In Column II, give the reason for your rejection of each.

Column I

Letters representing series above:

A
B
C
D

Column II

(This space is to be left blank for pupil free responses)
 Answers expected are given for the use of the teacher.

Answers:
 a. Each is too tall
 c. Each may have a distinct odor
 d. Candles too tall

- II. Specific Objective: To be able to choose topics of conversation better suited to meal time than some other topics.

GIVEN: Descriptions of topics sometimes discussed at family meals.

REQUIRED: Place a zero (O) in front of the topics which are often unsuited for mealtime conversation. Place an X (X-mark) in front of the kind of topic which is likely to be most satisfactory to family members.

- O A. Reasons for children coming home late last night.
 O B. The health of the pet dog.
 X C. Pleasant happenings of the day.
 O D. The high cost of groceries
 O E. The quality of the cooking on the table.

In Column I below, circle each letter which represents a topic above which you rejected. In Column II, circle the best reason for your rejections of topics.

Column I

- (A)
- (B)
- C
- (D)
- (E)

Column II
(Reasons)

- (1. Food is not easily digested)
- (when people are emotionally)
- (disturbed.)
- 2. Food is not easily digested
- when people are physically
- disturbed.
- 3. Bore some topic to some people.

III. Specific Objective: Knowledge of conventional table manners.

GIVEN: A list of practices observed in various situations.

- REQUIRED: (1) Place an X (X-mark) in the blank to the left of the practices which are conventionally approved.
- (2) Place a 0 (zero) in the blank to the left of practices which are usually considered least desirable.

Use of Napkins:

- 0 ☐ Unfold large napkin completely and place it on lap.
- 0 ☐ Tuck napkin under belt to keep it from slipping from the lap.
- X ☐ Unfold large napkin to half-size and place it in the lap.
- X ☐ Refold napkin after meals at home.
- X ☐ Pick napkin up from lap at about the center of the napkin and place it on the table to the left of the dessert plate after the meal.
- 0 ☐ Let napkin fall to the floor following the meal.
- 0 ☐ Use the edge of the table cloth to wipe finger tips.

Seating Arrangements:

1. In a group of two unmarried couples in a restaurant it is most polite for the women to sit:
 - X ☐ Facing each other
 - X ☐ To the right of their partners
 - 0 ☐ To the left of their partner
 - 0 ☐ Facing one of the men
 - 0 ☐ Anyway they want to.
2. When seating guests in your own home at a dinner table, the conventional pattern followed to seat the guests is:
 - X ☐ The oldest or more important woman guest to right of the host
 - X ☐ The oldest or more important man guest to the right of the hostess
 - 0 ☐ If there are two men and one woman, place the two men side by side.
 - X ☐ If there are two women and one man, the man sits between the women.

- ☒ Women sit to the right of the men
☐ Any place each chooses to sit.

3. If a woman comes to the table when a woman is eating with her date in a restaurant, it is polite for the woman to -

- ☒ Remain seated, unless the woman is very old
☒ Remain seated
☐ Stand up
☒ Introduce her to her date if she likes
☒ Invite her to be seated if she stays for any length of time.
☐ Tell her to run along so that one can continue eating
☒ Introduce her to the date if she has been invited to be seated.

4. When a boy is helping you to be seated, it is gracious for you to

- ☒ Enter your chair from your left as you face the table
☐ Enter your chair from your right as you face the table
☒ Seat yourself if you see he does not know how to help you
☐ Stand by your chair until he catches on
☒ Say "thank you" as you are being seated
☐ Say nothing so everyone can see that you are used to being helped
☒ As you are being seated, place your fingers under the edge of the chair seat and help guide the chair to the table
☐ Always seat yourself without help, it saves time and trouble and it is old-fashioned to be helped

5. If you enter a restaurant alone and see a boy and girl friend eating at a table it is most polite for you to -

- ☒ Speak politely and go on your way
☐ Speak politely and visit with them for a few minutes
☒ Be seated if they invite you to and you would like to
☐ Refuse to join them even if you would like to
☐ Try to impress the boy so that he can see what nice friends his date has

Habits when eating:

1. When eating soup, one is acting politely if one:

- ☒ Dips the spoon away from self if the soup is all liquid
☒ Dips the spoon toward self if there are solids in the soup
☒ Drinks the soup if it is served in a dish with handles
☐ Never drinks soup regardless of how it is served
☐ Breaks bread or crackers into the soup
☐ Makes a little noise in eating the soup
☒ Tips the soup plate away from self, to empty the plate completely.

2. When eating salads:

- ☒ Cut it with a knife, if you like.
☐ Cut it all up at one time.
☒ Cut a few bites only.
☐ Never cut it with a knife.
☐ Leave the salad fork on the dinner plate not on the salad plate.
☒ Eat olives, radishes, celery curls with the fingers.
☐ Place the entire olive, radish or celery curl in the mouth at one time. They are round and easy to drop.
☒ Leave the salad fork on the salad plate with the tines up.
☐ Leave the salad fork on the salad plate with the tines down.
☒ The salad to your left is usually yours whenever individual salad plates are used at the table.

3. If you drop food on your clothes, it is least embarrassing to all if you -

- ☒ Remove it immediately and make no comments.
☐ Ignore it.
☐ Remove it immediately and apologize for being so clumsy.
☐ Treat it as a joke and try to get everyone else to laugh.

4. Specific Objective: Knowledge of conventional practices in setting the table.

- GIVEN: Jane and Stan wish to set the table in the conventional way. Below in Column A is a list of dishes, glassware and silver to be used. In Column B possible positions are indicated.

REQUIRED: Place the number corresponding to desired position for each item listed in Column B.

Column A

- 3 A. Knife
 7 B. Bread and butter plate
 4 C. Teaspoon
 6 D. Water glass
 1 E. Salad plate
 5 F. Fork

Column B

- (1) to the left of the bread and butter plate.
 (2) to the right of the spoon.
 (3) to the right of the plate
 (4) to the right of the knife
 (5) to the left of the plate
 (6) at the tip of the knife
 (7) at the tip of the fork.

GIVEN: A list of statements and phrases relating to table setting and service.

REQUIRED: Place an X (X-mark) in the blank to the left of each phrase which correctly completes the statement. Place a 0 (zero) in the blank to the left of each phrase which completes the statement incorrectly.

An "individual cover" is a phrase conventionally used to designate.

- A. all the dishes on the table.
- B. the linen and silverware on the table.
- X 6. all appointments used by one person
- D. a silence cloth for the table.

D. Management

General Objective: To develop the ability to organize work.

- I. Specific Objectives:
- (1) Ability to work in a sequence producing the best quality of food nutritionally.
 - (2) Ability to work in a sequence which saves time and energy.

GIVEN: (1) The story of Mrs. Smith
 (2) Tasks to be done (Column B)
 (3) Estimates of time (Column A)

REQUIRED: To indicate in blanks in Column A the time when each task should be done in order to serve the most nutritious food and to conserve time and energy.

Story: At 10 o'clock in the morning, Mrs. Smith receives a telephone call from Mrs. Jones. Mrs. Smith invites Mrs. Jones and her four-year-old son to visit her at 3 o'clock that afternoon. At 12 noon Mrs. Smith must serve dinner to her family. She decides to serve cupcakes and lemonade to her afternoon guests. Mrs. Smith has already done her general housecleaning.

Column A - Estimates of Time

- ___ A. 10:00 - 10:15 A.M.
- ___ B. 10:15 - 10:45
- ___ C. 10:45 - 11:45
- ___ D. 12:45 - 1:00 P.M.
- ___ E. 1:00 - 1:50
- ___ F. 1:50 - 2:10
- ___ G. 2:10 - 2:20
- ___ H. 2:20 - 2:25

Column B - Tasks to be done

- (1) Straighten kitchen.
- (2) Make cupcakes.
- (3) Wash dinner dishes.
- (4) Make lemonade
- (5) Check on needed supplies for refreshments.
- (6) Prepare dinner.
- (7) Wash equipment used in making cupcakes.
- (8) Go to the grocery if necessary.

- II. Specific Objective: Ability to solve problems often met in preparing nutritious menus in a short time

Situation: Below is a copy of a menu which one girl tried to prepare in one hour. She was very late with the meal. Her kitchen was equipped with a 4-burner, 1 oven gas range, a refrigerator, a freezer, sink and cabinets.

GIVEN: (1) Copy of menu
 (2) List of changes
 (3) List of reasons for changes

- REQUIRED: (1) Replan menu so that it can be prepared in one hour.
 (2) Retain nutritive values similar to the original menu.
 (3) Give reasons for your choice of changes.

Directions: In Column I, place the letter which represents the changes you choose. In Column II, place the numbers which represent your reasons for the change.

<u>Column I - Changes</u>	<u>Column II - Reasons</u>	<u>Menu</u>
D	1, 2, 3, 4, 7	Cheese Souffle
H	1, 2, 4, 7	Buttered Green Beans with New
E	2, 3	Potatoes
F	1, 2, 3, 4, 7	Sliced Tomatoes
		Lemon Gelatin Cabbage Salad
		Hot Biscuits
		Peach Pie
		Milk

Changes which are desirable to reduce preparation time, retain nutritive, aesthetic values in the menu.

Reasons for changes.

- | | |
|--|---|
| A. Hot bread muffins | 1. Reduces number of manipulations required. |
| B. Whole tomato stuffed with shredded cabbage. | 2. Nutritive value similar to nutritive value in original menu. |
| C. Eggplant and cheese casserole | 3. Simplifies use of equipment |
| D. Fried fish | 4. Uses fewer utensils in preparation. |
| E. Cornbread | 5. Creates a more aesthetic menu. |
| F. Peaches and cream | 6. Reduces cost of menu. |
| G. Peach mousse | 7. Reduces time required to prepare a ready-to-eat dish. |
| H. Tossed tomato-cabbage salad | |
| I. Roast beef | |

- III. Specific Objectives: (1) To develop the ability to organize laboratory work in high school so that others will not be inconvenienced.
 (2) To develop an appreciation of the time problems involved.

Situation: Janet planned to serve the dinner menu which is listed below to three guests and herself at school in Home Economics department. She plans to serve this meal at 12:15 on Wednesday. She has one assistant who has the 8:00 hour free. Janet will be able to work on the luncheon on Monday, Tuesday, and Wednesday at 11:00 and in the Home Economics period at 2:00. In the blank before each job listed write the number which indicates the time when she should do the job.

MENU

Rolled Baked Flank Steak
 Baked Potatoes Buttered Carrots
 Green Tossed Salad Salad Dressing (bought)
 Hot Rolls (precooked) Butter
 Iced Tea
 Lemon Sugar
 Canned Peaches

Directions: In the blanks to the left of the list of jobs to be done, place the number which represents a time when the work can be done at school.

Jobs to be done*Time Schedule

- | | |
|--|---|
| 1 A. Check linen, china, and silver to be used. | (1) At 11:00 Monday. |
| 5 B. Set table and arrange centerpiece. | (2) During Home Economics period on Monday. |
| 1 C. Plan centerpiece to be used. | (3) At 11:00 Tuesday |
| 4 D. Stuff steak and store it in freezer. | (4) During Home Economics period on Tuesday. |
| 1 E. Make out grocery list. | (5) At 8:00 Wednesday |
| 4 F. Wash and store salad in ingredients. | (6) At 11:00 Wednesday |
| 4 G. Place peaches in the refrigerator. | (7) During the last 10 minutes before the meal is served. |
| 2 H. Do shopping for groceries. | (8) Just before people sit down to the table. |
| 4 I. Check ice in refrigerator. | (9) Between the main course and the dessert course. |
| 5 J. Wash potatoes, oil them, and place in pan. | (10) At Home Economics period on Wednesday. |
| 2 K. Wash and store carrots. | (11) At home. |
| 7 L. Make tea. | (12) Immediately after the meal. |
| 5 M. Put steak in oven, set thermostat and timer. | (13) Between 11:00 and 12:00 Wednesday. |
| 8 N. Fill water glasses. | |
| 6 O. Put potatoes in oven. | |
| 9 P. Remove peaches from refrigerator. | |
| 7 Q. Place food on the table. | |
| 13 R. Shred lettuce and cut up tomatoes and other ingredients. | |
| 8 S. Mix vegetables with salad dressing. | |
| 13 T. Put carrots on to boil. | |
| 13 U. Butter carrots | |
| 7 V. Fill glasses with tea and ice. | |
| 13 W. Slice lemon | |
| X. Light oven. | |
| 10 Y. Wash and store dishes. | |
| 12 Z. Temporary care of dishes and linens. | |

*Mackensen, Kathryn. Interdepartmental problems in time planning for meal service in a high school.

No one response in the above need be the only response. If the student shows ability to organize in a manner which makes cooperation with other departments in the school possible, and also shows an appreciation of the problems involved then the purpose will have been achieved. This study followed a study of tasks to be performed in order to serve the meal.

Competency in Caring for Food and Equipment

IV. Objective: To be able to solve problems met in cleaning up and dishwashing*. (Knowledge, understanding, and ability to apply.)

Directions: Below are three columns. Column I States problems which you may meet in caring for foods and in dishwashing. In Column II write the number of the solution from the list below which is correct for the problem. In Column III write the letter of the reason for your choice of solution.

<u>Column I</u> <u>Solution</u>	<u>Column II -</u> <u>Reason for Choice</u>	<u>Column III - Problems which may be met in caring</u> <u>for food and dishwashing.</u>
		How to care for:
		Left-over foods
		Greasy pans
		Soiled dishes (uncooked eggs.
		(milk.
		Soiled dishes (sirups or sugar.
		(most cooked foods.
		Pans in which food scorched.
		Aluminum pans containing scorched food.
		Tumblers and fragile cups.
		Woodenware
		Dish towels
		Sinks.
		Black spots on silver.
		Sanitation in dishwashing.

<u>Solutions</u>	<u>Reasons for Choice</u>
1. Soak in hot water, then scour with fine steel wool or powder.	A. Prevents formation of silver sulfide.
2. Cover and place in cool place when necessary.	B. Prevents mildewing
3. In drying place where air can get to all parts.	C. Prevents spoilage and absorption of odors.
4. Soak in hot water	D. Destroys bacteria and other harmful organisms.
5. Wipe with absorbent paper.	E. Removes coating of fat clinging to utensil
6. Soap in fine powder	F. Cleans without scratching or roughening surface.

*Broussard, Theresa.

7. Hot, soapy water followed by rinse in scalding water.
8. Soak in cold water.
9. Hot, soapy water followed by rinse in hot water.
10. Hot water and a little washing soda.
11. Wash promptly to remove egg, mustard and salad dressing.
- G. Dissolves or softens the food.
- H. Prevents "Tattle-tale" gray and the harboring of bacteria.
- I. Cleans and does not darken the metal.
- J. Scalding may cause breaking
- K. Prevents hardening of food by preventing coagulation of the protein.

V. Specific Objective: Ability to purchase maximum nutritive values at lowest cost possible.

- GIVEN: 1. A list of uses to be made of a milk supply by a family. (Column A)
2. A list of forms in which the family may purchase the milk (Column B)

REQUIRED: In Column A, circle the numeral which represents the most economical and nutritious purchase for the purpose indicated.

Column A

Column B

Ways in Which Milk is to be Used:

Possible Forms in Which it may Be Purchased

To be used in a formula for an infant - 1 2 3 (4)
5 6 7 8

1. Dried, skimmed.
2. Raw, skimmed
3. Condensed.
4. Evaporated.
5. Pasteurized, whole.
6. Homogenized
7. Certified, whole
8. Buttermilk

To be used as a beverage by a 4 year old child
1 2 3 4
(5) 6 7 8

To be used in cooking processes -
(1) 2 3 4
5 6 7 8

VI. Specific Objective: Knowledge of practices which affect the cost of operating and maintaining electric refrigerators.

- GIVEN: A list of practices seen in the use of electric refrigerators (Column I).
- A list of possible results when these practices are followed.

REQUIRED: In Column I, circle the numeral which represents the likely result when the practices are followed.

Column I

Column II

Practices

Results

Permitting heavy frost to form on the ice compartment.

1. Will result in need for replacement in a short time.

1 2 (3) 4 5

Touching rubber gasket with hands.

(1) 2 3 4 5

Opening the door frequently.

1 2 (3) 4 5

Exposing to acids.

1 (2) 3 4 5

Placing hot water in trays to make ice cubs.

1 2 (3) 4 5

2. Will cause stains.
3. Will cause motor to run for longer periods
4. Will decrease freezing time required.
5. None of the above four results apply

V. Specific Objective: To recognize practices in food preparation which save time and energy.

- GIVEN: (1) A list of practices observed in some kitchens
 (2) A list of foods preparation processes which are usually associated with specific manipulative practices.

REQUIRED: In Column I, circle the numeral which represents the process that will save time and energy.

Column I -

Food Preparation Processes

Paring potatoes

1 2 (3) 4 5 6 7

Peeling citrus fruit

1 2 (3) 4 5 6 7

Measuring shortening

(1) 2 3 4 5 6 7

Measuring flour

1 (2) 3 4 5 6 7

Sifting flour

1 2 (3) 4 5 6 7

Column II -

Practices Associated with the Process

1. Using a measured amount of water.
2. Using standard measuring cup that does not have a lip.
3. Using a paper on the work table surface.
4. Using a spatula.
5. Directly into a bowl
6. Working near a sink.
7. None of the above applies

APPENDIX B

FOOD HABIT RECORD FORM

Directions For Keeping Your Food Record

1. Write Down How Much You Eat of Each Food. Tell how many teaspoonfuls or tablespoonfuls you eat; tell whether you eat $1/4$ or $1/2$ or 1 cupful, and tell how many slices of bread.
2. Be Sure to Write the Kind of Food you Eat. If you eat cereal, write oatmeal, shredded wheat buscuit or whatever kind of cereal it is. Be sure to tell the kind if you eat any of these foods: bread, meat peas, beans, potatoes, soups, salads, or sandwiches - like this:

Soups - cream of tomato, navy bean, split pea, vegetable

Salads - mixed vegetable (raw), fruit (cooked), tuna

Sandwiches - 2 slices of whole wheat bread, butter,
peanut butter

2 slices of white bread, mayonnaise;
American cheese.

After you finish writing your record, see if you did these things:

1. Did you write down only the foods you put in your mouth and swallowed?
2. Did you write down HOW MUCH you ate or drank?
3. Did you miss a meal? If so, did you write the word NOTHING in the space for that meal? If you didn't eat between meals, did you write the word NOTHING in the space for between-meal foods?

Name _____ Date _____

School _____

BREAKFAST:

Kind of fruit _____ Amount _____

Cereal: Kind _____ Amount _____

Bread	(Whole wheat _____	Amount _____
	(White _____	Toasted (Yes _____
	(Biscuits _____	(No _____
	(Other kind _____	

Butter: Amount _____

Egg: Amount _____ How cooked? _____

Bacon: Number of slices _____

Milk:	(On cereal _____
	(To drink _____
	(In coffee _____
	(Other _____

Sugar: Amount _____

Other foods eaten: _____

BETWEEN BREAKFAST AND LUNCH:

Foods eaten _____	Amount _____
_____	Amount _____
_____	Amount _____

LUNCH:

Meat or fish: Kind _____ Amount _____

Potatoes: White _____ Amount _____

Sweet _____ How Cooked? _____

Rice: Amount _____

Spaghetti: Amount _____

Gravy: Amount _____

Vegetables: Cooked. Kind _____ Amount _____

Kind _____ Amount _____

Raw Kind _____ Amount _____

Kind _____ Amount _____

Bread: Kind _____ Amount _____

Butter: Amount _____

Sandwich Filling. Kind _____ Amount _____

Fruit: Cooked. Kind _____ Amount _____

Raw Kind _____ Amount _____

Salad dressing: Kind _____ Amount _____

Dessert: Kind _____ Amount _____

Milk: Amount _____

Other beverages: Kind _____ Amount _____

Sugar: Amount _____

Other food eaten: Kind _____ Amount _____

Kind _____ Amount _____

FOODS EATEN BETWEEN LUNCH AND SUPPER:

Kind _____ Amount _____

Kind _____ Amount _____

Kind _____ Amount _____

Name _____ Date _____

School _____

BREAKFAST:

Kind of fruit _____ Amount _____

Cereal: Kind _____ Amount _____

Bread	(Whole wheat	_____	Amount (yes _____ (no _____)
	(White	_____	
	(Biscuits	_____	
	(Other kind	_____	

Butter: Amount _____

Egg: Amount _____ How cooked? _____

Bacon: Number of slices _____

Milk: (On cereal _____
(
(To drink _____
Amount (_____
(In coffee _____
(
(Other _____

Sugar: Amount _____

Other foods eaten: _____ Amount _____

_____ Amount _____

BETWEEN BREAKFAST AND LUNCH:

Foods eaten _____ Amount _____

_____ Amount _____

_____ Amount _____

Bollworm and Tobacco Budworm As Cotton Pests In Louisiana and Arkansas

by

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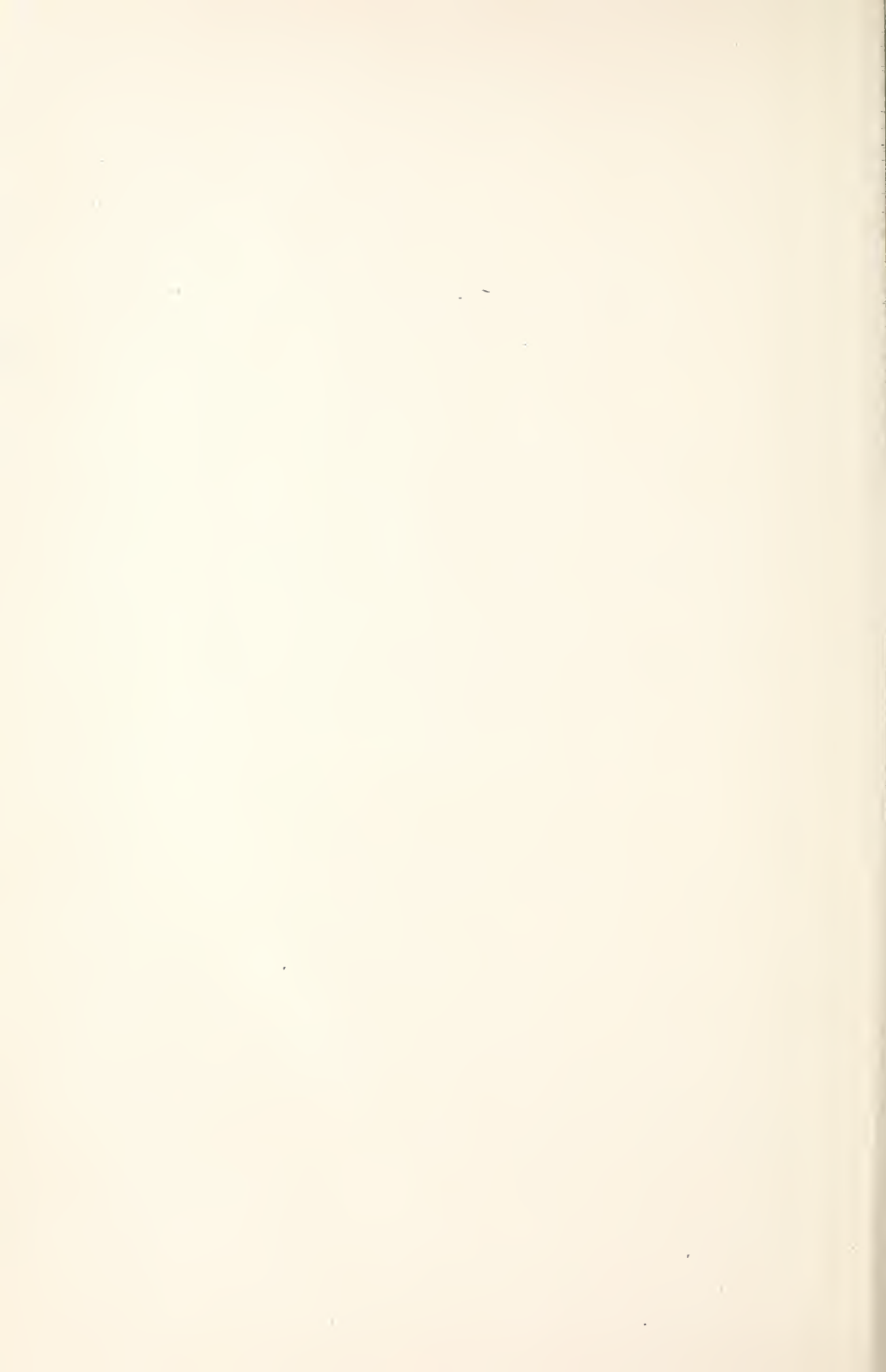


Female of the bollworm, *H. armigera*, above, and of the tobacco budworm, *H. virescens*, below.

This is a joint publication of the Louisiana Agricultural Experiment Station and the Arkansas Agricultural Experiment Station. The studies reported herein were conducted separately by the two groups of workers at the respective stations. The data are considered mutually supplemental and have been combined in this publication to present a more complete report than would result from separate publication.

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Bollworm and Tobacco Budworm As Cotton Pests in Louisiana and Arkansas^{1,2}

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Introduction

Bollworms are important pests of cotton in Louisiana and Arkansas, outranked only by the boll weevil. Prior to 1949 the bollworm, *Heliothis armigera* (Hbn.), was regarded as the only species of importance on cotton. Since that time the tobacco budworm, *H. virescens* (F.), has been found attacking cotton in large numbers, especially in the early part of the fruiting period.

Much is known of host relationships, causes of outbreaks on cotton and other crops, natural control and insecticidal control of the bollworm. Comparatively little of such information is available on the tobacco budworm.

Research in both states was carried on to assess the relative importance of the two species and to obtain information on host relationships, causes of outbreaks and methods of controlling the tobacco budworm. Efforts were also directed toward finding an explanation for the sudden rise of the tobacco budworm to the status of a serious cotton pest. Lacking such information, it cannot be assumed that outbreaks of this species arise from the same causes and are controlled in the same manner as the bollworm. A third species, *H. subflexa* (Gn.), was also studied because of its close resemblance to the tobacco budworm.

Common Names

Heliothis armigera bears the common name of bollworm, corn earworm and tomato fruitworm approved by the American Association of

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Economic Entomologists. When found on tobacco it is commonly called the false tobacco budworm but this name has not been approved. In this bulletin *H. armigera* will be referred to as the bollworm.

Heliothis virescens bears the approved common name of tobacco budworm. It will be referred to as such throughout this bulletin although it is being considered as a cotton pest which causes damage practically identical to that caused by the bollworm.

In discussing outbreaks on cotton the term bollworm will be used although it is recognized that both species have been involved to some extent.

The third species studied, *Heliothis subflexa*, has no common name. Since it is not a crop pest, none is needed.

Partial Review of Literature

The bollworm has been recognized as a cotton pest since 1820. It is a general feeder and is known to attack more than 70 species of plants (Quaintance and Brues, 1905). According to Isely (1935) corn is the most favorable host in Arkansas, and a succession of plantings of corn is favorable to the abundance of the species. He also found that legumes grown in combination with corn extended the breeding season of the bollworm.

Bollworm moths choose succulent, rank-growing cotton for oviposition rather than less vigorous growth (Thomas and Dunnam, 1931).

Bollworm outbreaks in cotton appear to be favored by the absence of silking corn, high aphid populations and hot, dry weather which shortens the silking period of corn. Early corn builds up populations of moths that may migrate to cotton but later plantings of corn can be used as a trap crop (Lincoln and Isely, 1947).

More eggs and larger larval populations of bollworms were frequently found on plots dusted with arsenicals than on undusted check plots (Ewing and Ivy, 1943). They listed 12 species of predaceous insects commonly found on cotton that were able to survive on bollworm eggs. Increases in bollworm infestations were frequently associated with increased aphid populations after cotton had been dusted with arsenicals. Their laboratory and field cage tests showed that larger numbers of bollworm eggs hatched and more larvae survived when aphids were abundant than when aphids were absent.

The new organic insecticides such as BHC, DDT and toxaphene destroyed more of the predator populations, especially those with sucking mouthparts such as the big-eyed bug, *Geocoris punctipes* (Say), and the insidious flower bug, *Orius insidiosus* (Say), than calcium arsenate. The widespread use of these insecticides has resulted in the occurrence of more frequent bollworm outbreaks in recent years (Newsom and Smith, 1949).

The tobacco budworm is a tobacco pest of long standing. According to Morgan and Chamberlin (1927) tobacco and beggar weeds, *Meibomia* spp., are the principal hosts in Florida. Tomatoes, garden peas and sweet peas were of secondary importance.

In 1934 at Tallulah, Louisiana, the tobacco budworm occurred on cotton in almost as great numbers as the bollworm (Folsom, 1936). It attacked the plant in the same manner as the bollworm but preferred squares to bolls and ate leaves more freely. He suggested that much of the damage attributed to the bollworm could be caused by the tobacco budworm.

There seems to be no authentic earlier record than Folsom's of the occurrence of the tobacco budworm on cotton in the United States. Riley (1885) identified 25 pupae dug from a cotton field at Cairo, Georgia, in February 1879 as *Heliothis* (*Aspila*) *virescens*. Because of the difficulty of identifying species from pupae this record cannot be accepted as a positive one. Howard (1900) states, "the insect has several other foodplants aside from cotton..." From the context it appears that he meant tobacco and not cotton.

The tobacco budworm attracted wide attention as a cotton pest in 1949 and each year since. It was usually more numerous early in the season on cotton, and the bollworm became more numerous later in the season (Conference Report, 1952).

Larval characters by which the bollworm could be distinguished from the tobacco budworm were described by Crumb (1926).

Heliothis subflexa was described by Guenee in 1852 but was relegated to the status of a variety or geographical race of the tobacco budworm in 1903, according to McElvare (1941), who restored this species to specific rank.

***Heliothis* as Cotton Pests in Other Countries**

Host relationships of the bollworm and tobacco budworm vary greatly in different countries. According to Wolcott (1933) both species occur throughout the West Indies. The bollworm is common on corn and also attacks cotton throughout the islands. It is a pest of tobacco in Jamaica but not elsewhere. The tobacco budworm is common on pigeon pea throughout the islands. It occasionally attacks cotton. In Cuba it is a pest of tobacco.

The bollworm is never found on cotton in Peru but is abundant on corn. The tobacco budworm is a major cotton pest there and also attacks corn as well as a variety of other plants (Hambleton, 1944; Wille, 1951; and Lincoln, unpublished).

The differences in food habits in the bollworm and tobacco budworm in the West Indies, Peru and the United States indicate the existence of

biological races of both species. Knowledge of host relationships in one area is of little value in interpreting the relationship in another area.

Character of Injury

Damage to cotton by the two species of *Heliothis* cannot be distinguished. The tobacco budworm tends to feed more readily on foliage but this is not a dependable character for separating injury caused by the two species.

Eggs of both species are laid on terminal growth and fruiting forms. Upon hatching, the young larva tunnels through leaf buds and tiny squares. These small squares turn brown (blast) and may be mistaken for fleahopper injury. Close inspection will reveal the entrance hole into the square through the bract. The small larva leaves a trail of fine webbing in the terminal growth. Its feces are usually entangled in this web.

The larva next feeds on medium sized squares, making entrance holes about the diameter of baling wire or larger. Usually only one hole is made to the square. Injured squares turn yellow, flare and fall from the plant. The characteristic type of entrance hole makes it easy to distinguish bollworm damage from that caused by the boll weevil.

The large larva usually feeds on bolls if they are available. It also feeds on pollen in open blooms. Entrance holes in the boll are about half the diameter of a lead pencil. The entire contents of a boll are sometimes consumed. Boll rots usually follow bollworm attack so that a damaged boll is usually a total loss.

In its journey down a cotton stalk one larva may destroy several fruiting forms.

On other plants both species tend to tunnel in the fruit or tender terminal growth. Tender foliage may be attacked in the absence of fruit. When feeding exposed on foliage larvae are susceptible to attack by parasites and predators and are more easily controlled by insecticides.

Host Plants

During the period August 1949 to May 1953, 11,753 *Heliothis* larvae were collected from 25 host plants in Louisiana and Arkansas. Distribution of the three species on the various hosts is presented in Table 1.

The bollworm was the only species collected from corn, grain sorghum and lima beans. It was also the only species taken from cowpeas, snap beans, chrysanthemum, *Hibiscus rosa-sinensis*, vetch, croton, Korean lespedeza and bur clover; however, only a few specimens were taken from each of these hosts. The bollworm was the dominant species on tomato, soybean, alfalfa, white clover, rose, *Sida spinosa* and lupine, var. Hasting's white, although a few tobacco budworm larvae were taken from each of these. Five other varieties of lupine, including sweet blue,

TABLE 1—Field Collections of *Heliothis* Larvae from Several Hosts in Louisiana and Arkansas.

Host	Date collected	Number larvae collected			
		H. armigera		H. virescens	
		La.	Ark.	La.	Ark.
Cotton	Aug. 1949	....	53	....	6
Cotton	Sept. 1949	237	20	59	0
Cotton	Oct. 1949	73	....	34	—
Cotton	Dec. 1950	12	....	1	—
Cotton	Aug. 15-Oct. 2, 1951	200	28	109	16
Cotton	June-July 1952	65	54	630*	47
Cotton	Aug.-Sept. 1952	1195	264	66	49
Corn	May 8-Aug. 28, 1952	2016	662	0	0
Grain sorghum	Aug.-Sept. 1951 & 1952	247	176	0	0
Tomato	June-July 1952	....	28	....	1
Tobacco	May-Aug. 1952	0	0	42	5
Tobacco	May 1953	7	....	86	....
Soybean	July-Sept. 1952	52	260	0	9
Lima bean	Aug.-Sept. 1952	2	26	0	0
Cowpea	Sept. 1952	6	....	0	—
Snap bean	Oct. 1952	....	1	....	0
Alfalfa	May-Nov. 1952	1253	19	2	0
Alfalfa	April 1953	12	....	0	—
Lupine, var. Hasting's white**	April 1952	265	....	0	—
Lupine, var. Hasting's white	April 1953	1912	....	9	....
Crimson clover	April-May 1952	378	....	356	—
Crimson clover	April 1953	147	....	7	....
White clover	April-May 1952	54	....	1	—
White clover	April 1953	4	....	2	—
Bur clover	March-April 1949	7	....	0	—
Bur clover-red clover mixture	June 1952	9	....	1	—
Hairy vetch	Feb.-April 1952	9	....	1	—
Crotalaria	Sept. 1952	10	....	0	—
Korean lespedeza	Sept. 1952	....	1	....	0
Rose	Sept. 1952	78	....	1	—
Chrysanthemum	Sept. 1952	3	....	0	—
Snapdragon	April 1953	0	....	59	—
<i>Hibiscus rosa-sinensis</i>	Sept. 1952	16	....	0	—
<i>Jacquemontia tamnifolia</i>	Sept.-Oct 1951, 1952	42	....	58	—
<i>Sida spinosa</i>	Sept. 1951	49	....	1	—
<i>Abutilon Theophrasti</i>	Sept. 1952	....	3	....	8
<i>Physalis</i> sp. ***	Oct.-Nov. 1951, 1952	0	....	0	—

* In Louisiana relatively large numbers of *H. virescens* were obtained by rearing larvae from eggs collected in June.

** Five other varieties of lupine planted in randomized blocks with Hasting's white lupine were not infested.

*** A total of 132 larvae was collected. All were *Heliothis subflexa*.

alta blue, Florida speckled, common blue and white-seed yellow, planted in randomized blocks with Hasting's white were not infested by either species.

The tobacco budworm was the only species collected from tobacco in 1952, but a few bollworm larvae were taken on this host during 1953. Crimson clover and a morning glory, *Jacquemontia tamnifolia*, were infested about equally by the bollworm and tobacco budworm. Eight of 11

specimens from button weed, *Abutilon Theophrasti*, were the tobacco budworm. Fifty-nine specimens from snapdragon in April 1953 were this species.

Of 3218 specimens collected from cotton 2201 were bollworms and 1017 tobacco budworms. In both states the bollworm was the dominant species after August 1, comprising 80 per cent of the population in 1949, 87 per cent in 1951 and 93 per cent in 1952. In June and July 1952 the tobacco budworm made up 91 per cent of the population in Louisiana. Many of these specimens were obtained by rearing larvae from eggs collected from cotton. In Arkansas during June and July a few more bollworms than tobacco budworms were collected.

Heliothis subflexa was found only on ground cherry, *Physalis* sp. Neither the bollworm nor the tobacco budworm was collected from this host. Ground cherry has been reported as a host for all three species, but some of these reports may have resulted from confusion with *H. subflexa*, especially in the case of the tobacco budworm.

Results of these collections generally confirm those of other workers insofar as the bollworm is concerned. A variety of winter legumes and pasture clovers serve as hosts for the first generation. Corn is the preferred summer host but cotton, soybean, grain sorghum, lima bean and others are suitable alternatives. Alfalfa is a satisfactory host which is available over a long period of time.

The tobacco budworm was found to have a more restricted host range. Although occasionally found on several hosts, the most important ones seem to be cotton, crimson clover, *Jacquemontia tamnifolia* and tobacco. Cotton is the important summer host in Louisiana and Arkansas. Tobacco acreage is so restricted in these states that it does not affect the over-all abundance of this insect. *Jacquemontia tamnifolia* is a late season host and serves to extend the breeding season. Crimson clover is an important host before cotton becomes available. Button-weed might be of considerable importance because it is a common weed, but collections from this host were too limited to give a true picture.

The most thorough previous host plant study of the tobacco budworm was that by Barber (1937) in eastern Georgia. He found Florida beggar weed, *Meibomia purpurea*, toadflax, *Linaria canadensis*, and deergrass, *Rhexia alifanus*, to be the most important wild hosts. Flax and tobacco were the most important cultivated hosts but were less attractive than the favorite wild hosts. A total of 14 wild hosts was recorded.

In this same study by Barber the bollworm was found on 7 wild and 11 cultivated host plants and was more closely associated with the cul-

tivated than the wild hosts. The most important cultivated hosts were corn, soybean, flax and tobacco. Cotton was not attacked by either species. The tobacco budworm was found to be fully as abundant during a given season as was the bollworm even though not feeding on any cultivated crop.

Tobacco and beggar weed, *Meibomia* spp., were listed by Morgan and Chamberlin (1927) as preferred hosts of the tobacco budworm in Florida, with tomatoes, garden peas and sweet peas being of secondary importance.

The difference in host relationships found by these workers and in the present studies may be explained by regional differences in availability of wild and cultivated host plants. However, the possibility of biological races should not be ignored.

Life History Studies

The life history of the bollworm in relation to cotton has been studied by Quaintance and Brues (1905), Bishopp (1929) and Isely (1935). Such studies of this species were not repeated here except when incidental to other studies.

The incubation period of the tobacco budworm was 3 to 5 days during hot weather. Larval development required 18 to 31 days in May and June; and the pupal period was 12 days in summer. The first generation completed development in 46 days but later generations could complete development in as little as 33 days (Morgan and Chamberlin, 1927).

Rearing of the tobacco budworm for life history studies was done in an open air insectary at Fayetteville, Arkansas, at prevailing summer temperatures and in a laboratory at room temperature at Baton Rouge, Louisiana. Larvae were usually reared in glass tubes plugged at one end with plaster of Paris or in glass vials, 15 by 95 millimeters, inverted over a sand table. Moistening the plaster of Paris or the sand at regular intervals served to maintain favorable humidity. Pupation was in sand in the glass vials or in jelly glasses filled with soil or sand. Adults were kept in one-gallon, wide-mouthed jars and battery jars for oviposition studies and were fed honey diluted with water. At Baton Rouge it was necessary to cage bollworm adults in large cages over cotton plants before they would mate, but tobacco budworm adults mated readily in one-gallon jars.

At summer temperatures incubation of tobacco budworm eggs usually required three days. Larval feeding was completed in two weeks on favorable hosts and at an average temperature above 82 degrees F. On unfavorable hosts and at an average temperature below 70 degrees F. the larval feeding period extended over a seven-week period.

The period in the soil representing the combined prepupal and pupal periods varied from 12 to 32 days. During August with an average temperature in the lower 80s the range was from 12 to 17 days with an average of 13.2 days for 56 individuals. Longer periods were required for those pupating in September and October.

The preoviposition period varied from 3 to 22 days; and the oviposition period varied from 4 to 27 days.

Comparison with figures published by Isely (1935) shows that the tobacco budworm requires about the same amount of time for development as the bollworm. When the two species were reared simultaneously at Baton Rouge the tobacco budworm developed in slightly less time than the bollworm on cotton but required more time when reared on corn (Table 2).

TABLE 2—Comparative Rates of Larval Development of the Tobacco Budworm and Bollworm on Several Hosts. Baton Rouge, Louisiana, 1952.

Host	No. larvae each species	No. pupating		Days required for larval development	
		Bollworm	Tobacco budworm		
				Bollworm	Tobacco budworm
Cotton bolls	60	26	39	17.8	14.3
Cotton squares	10	0	3	.....	10.7
Cotton terminals	20	0	13	.....	17.2
Corn ears	50	14	35	16.0	15.2
Corn tassels	10	0	4	.....	13.0
Corn silks	10	0	3	.....	16.0
Alfalfa	10	0	3	.....	16.0
Hairy vetch foliage	10	1	4	20.0	16.0

Relation of Host Plant to Duration of Larval Feeding Period—Duration of larval feeding period of the tobacco budworm varied with the host plant. Larvae completed their development on soybean pods, grain sorghum heads and cotton bolls in 13 to 14 days. The larval feeding period required 17 to 21 days on soybean seedlings, soybean foliage, corn tassels, corn ears in the milk and early dough stage, snap bean, cotton squares and cotton foliage. Tomato foliage and fruit, alfalfa, and tobacco leaf buds were poor hosts on which 23 to 30 days were required for completion of larval development. On such unfavorable hosts survival was very low. None was reared to maturity on lespedeza and tomato foliage. Results are given in Table 3.

Cannibalism—The cannibalistic nature of the bollworm is well known. In these studies it was observed that the tobacco budworm also became cannibalistic in the third and fourth instars, particularly if crowded. Observations indicated that the bollworm was, however, more cannibalistic than the tobacco budworm. A test was conducted to check the accuracy of this observation. Larvae of both species were reared

TABLE 3—Effect of host plant on duration of larval feeding period and survival of the tobacco budworm. Fayetteville, Arkansas, 1952.

Host	No. larvae	Per cent pupating	Ave. temp. (Degrees F.)	Feeding period in days	
				Observed	Estimated at 82 F.*
Soybean pods	49	55	82.2	13.0	13.3
Grain sorghum heads	50	30	80.9	15.4	13.7
Cotton bolls	67	33	76.9	21.5	14.0
Soybean seedlings	103	18	83.3	15.3	17.3
Snap beans	63	51	84.7	13.5	17.5
Corn ears	48	35	83.8	15.3	18.0
Soybean foliage	40	20	78.7	23.4	18.4
Cotton squares	189	19	77.7	25.9	19.4
Tomato fruit	70	2	83.5	21.0	23.2
White clover heads	12	8	83.2	21.0	23.2
Alfalfa foliage	62	3	83.2	24.5	26.3
Tobacco leaf buds	90	3	69.9	48.0	29.8
Lespedeza	50	0			
Tomato foliage	20	0			

*1½ days were arbitrarily allowed for each degree F.

in groups of 10 on cotton foliage and bolls in one-gallon glass jars having about two inches of moist sand in the bottom. Food was changed as often as necessary. The test was replicated five times. Of the 50 larvae of each species included in the test 24 tobacco budworm and only 3 bollworm pupated. Subsequently, mass rearing techniques were found highly satisfactory for maintaining laboratory cultures of the tobacco budworm but not for the bollworm.

Weight of Pupae—Weight of tobacco budworm pupae reared at Fayetteville, Arkansas, varied from 88 to 315 milligrams. Thirteen pupae from larvae fed cotton bolls weighed an average of 212 milligrams while 8 from soybean foliage averaged 115 milligrams. Pupae from larvae fed on nine other hosts were intermediate in weight, averaging 144 to 190 milligrams. Variation of pupal weights on any host was greater than that between hosts. Data are presented in Table 4.

Weight of pupae from larvae fed hairy vetch foliage was compared to that from larvae fed soybean seedlings at Baton Rouge. A total of 39

TABLE 4—Weight of pupae of the tobacco budworm from larvae fed on various hosts. Fayetteville, Arkansas, 1952.

Host	No. individuals	Weight in milligrams		
		Max.	Min.	Ave.
Cotton bolls	13	315	125	212
Corn ears	5	228	165	189
Snap beans	15	225	143	181
Sorghum heads	15	225	129	178
Soybean pods	27	248	130	177
Cotton squares	22	240	106	173
Cotton foliage	15	194	124	163
Soybean seedlings	9	195	117	157
Corn tassels	5	155	118	144
Soybean foliage	8	137	88	115

males and 26 females was reared on each host. The heaviest pupa came from this series, a male fed on soybean seedlings weighing 334 milligrams. Pupae from larvae fed soybean seedlings averaged 244 milligrams and from hairy vetch foliage 214 milligrams.

Males were fully as large as females and possibly slightly larger. Males were 10 per cent heavier than females in 64 pupae from 4 hosts at Fayetteville, Arkansas (Table 5). Males were 6 milligrams heavier than females from hairy vetch and 2 milligrams lighter from soybean seedlings at Baton Rouge, Louisiana (Table 6).

TABLE 5—Weight of male and female pupae of the tobacco budworm compared. Fayetteville, Arkansas, 1952.

Host	No. pupae		Weight of pupae in milligrams	
	Female	Male	Female	Male
Cotton bolls	5	5	195	238
Cotton squares	5	8	186	190
Soybean pods	13	14	172	183
Sorghum heads	7	7	168	182

TABLE 6—Weight compared of male and female pupae from larvae fed hairy vetch foliage and soybean seedling. Baton Rouge, Louisiana, 1953.

Host	Weight of pupae in milligrams					
	Male			Female		
	Max.	Min.	Ave.	Max.	Min.	Ave.
Hairy vetch foliage	260	153	217	248	174	211
Soybean seedling	344	200	243	304	200	245

Oviposition—Oviposition records were obtained from 54 female moths. Thirty-nine of these laid fertile eggs, averaging 372 eggs each. It was not uncommon for a moth to deposit both fertile and infertile eggs. The maximum number of eggs deposited by one moth was 1025. This is considerably below the maximum reported for the bollworm (Isely, 1935). Oviposition records and the effect of larval food on fecundity of adults are presented in Table 7.

Individual moths developing from soybean seedlings, cotton squares, cotton foliage, soybean pods, corn ears, corn tassels, and grain sorghum heads deposited over 500 eggs each. Only two fertile females from cotton bolls and two from soybean foliage were included in this study. Of the two from cotton bolls, the greatest number of eggs deposited was 265 while the greatest number from soybean foliage was 58.

Fecundity was correlated with size of moths as indicated by weight of pupae. A higher proportion of the heavier individuals laid fertile eggs and the number of eggs deposited was greater (Table 8).

Distinguishing Characteristics

Since the bollworm and the tobacco budworm occur in mixed populations on cotton and since *H. subflexa* is so remarkably similar to the

TABLE 7—The effect of larval food on fecundity of the tobacco budworm.
Fayetteville, Arkansas, 1952.

Host	No. females	No. laying fertile eggs	Length in days						No. eggs per female		
			Preoviposition period			Oviposition period					
			Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
Snap bean A*	4	4	3	7	5.8	6	20	12.3	42	1025	463
Soybean A*	5	5	4	7	5.2	10	15	12.4	208	802	469.4
seedling B**	1	1			13			9			83
Cotton A	3	2	5	9	7	13	18	15.5	125	760	442
squares B	5	2	15	16	15.5	4	6	5.0	22	430	226
Cotton foliage A	3	3	5	10	8	7	15	11.3	69	757	323.7
Corn ear A	2	2	5	6	5.5	16	19	17.5	420	729	574.5
Corn tassel A	1	1			4			20			702
Soybean pod B	13	9	6	16	9.4	7	27	14	77	741	488
Sorghum head B	7	6	6	13	9.7	6	14	10.5	55	562	258.5
Cotton boll B	5	2			12	5	9	7	194	265	229.5
Soybean foliage B	5	2	16	22	19	9	11	10	38	58	48

A* Adults from larvae hatched about July 15.

B** Adults from larvae hatched about August 15.

TABLE 8—Correlation of weight of pupae with number of eggs deposited by the adult. Fayetteville, Arkansas, 1952.

Weight of pupae in milligrams	No. female moths	No. fertile moths	Ave. No. eggs per moth	Ave. No. eggs per fertile moth
200-315	7	6	311	363
150-200	15	8	193	352
90-150	15	8	106	199

tobacco budworm, it is desirable to be able to distinguish between all stages of the three species. Laboratory cultures were established at Baton Rouge, Louisiana, and all stages were studied for characters by which the three species could be identified.

Egg—No differences could be found by which the eggs could be separated and for all practical purposes eggs of the three species may be considered as being identical in appearance.

Larva—This is the most commonly noticed stage and the one responsible for crop damage. It is the stage in which need for identification most often occurs. Larvae of all three species were so similar in the first two instars that they could not be identified.

The characters which identify the tobacco budworm first appear in the third instar. At this time the setigerous tubercles, especially the dorsal pair on abdominal segments one, two and eight, are covered with small spinules similar to those on the body surface. This character occurs throughout all subsequent instars. Also a basal process appears on the

oral face of the mandible. This process is quite small in the third instar and may be easily overlooked, but it becomes larger and tooth-like in appearance during the fourth, fifth, and sixth instars. Both of these characters should be used for identifying larvae.

Characters by which larvae of *H. subflexa* may be identified appear in the fourth instar. Microspines appear at this time on the setigerous tubercles of abdominal segments one, two and eight. Also a basal process appears on the ventral rib of the oral face of the mandible. This basal process becomes larger in subsequent instars but does not become toothed until the sixth instar. Therefore, the differences between the tobacco budworm and *H. subflexa* after the third instar are complicated by the presence of a basal process on the oral face of the mandible and microspines on the setigerous tubercles of both species. However, *H. subflexa* has microspines present on only the basal half of the tubercles and these spinules are shorter and coarser than those of the tobacco budworm which cover the entire tubercle.

Host specialization was found to be the most convenient means for separating larvae of *H. subflexa* from the other two species in this study. *H. subflexa* larvae were found only on *Physalis* spp. Neither the bollworm nor the tobacco budworm was found on this plant.

Bollworm larvae may be distinguished from the other two species after the third instar by the absence of microspines on the setigerous tubercles except that a few may appear around the basal edges in the fifth and sixth instars. Also the basal mandibular process present in the other two species never occurs in bollworm larvae. In some larvae of the bollworm an enlargement occurs about midway of the first ventral-ridge but never a basal process as in the other species.

Taxonomic characters for distinguishing between larvae of the three species of *Heliothis* are illustrated in Figures 1 through 24.*

Key to Larvae After Third Instar

1. Spinules absent on setigerous tubercles except for a few along basal margin in fifth and sixth instars. Oral face of mandible without a basal process *H. armigera* (bollworm)
2. Spinules present on setigerous tubercles. Basal process on oral face of mandible 3
3. Relatively long, slender spinules covering the entire surface of the setigerous tubercles *H. virescens* (tobacco budworm)
4. Relatively short, coarse spinules covering only basal half of setigerous tubercles. Found only on *Physalis* spp. *H. subflexa*

Pupa—No characters by which the three species could be separated were noted in this stage. The pupae of the bollworm are generally larger than those of the other two species.

*Photographs by H. Bruce Boudreaux, Louisiana State University.

Adult—The adult of the bollworm is readily distinguished from the other two species. It is larger and the color varies from a light brown with a greenish cast in the male to a deep reddish brown in the female. The male can be distinguished from the female by the lighter color and greenish cast as described by Smith and Allen (1928).

Adults of the tobacco budworm and *H. subflexa* have the same olive green color with three oblique white lines across the front wings which distinguishes them from the bollworm. However, these two species are remarkably similar in appearance. Both external and internal differences for separating the two were described by McElvare (1941), who reestablished the validity of *H. subflexa* as a species. According to McElvare, *H. subflexa* differs externally from the tobacco budworm by the absence of a band on the hind wings which are immaculate.

Beginning in the spring of 1952 moths reared in the laboratory were examined for the presence of a band on the hind wings. Over 200 *Heliothis* moths other than the bollworm were reared from eggs and small larvae collected from cotton in the field. All specimens of both sexes had a band of varying width and color on the hind wings. From this study it appeared that *H. subflexa* did not attack cotton, and McElvare's description of a colored band on the hind wings of both sexes of the tobacco budworm was confirmed.

Later, larvae were collected from *Physalis* sp. and reared to adults. As the adults emerged it was noted that only the males had an immaculate hind wing. Females from larvae collected from this host had a band on the hind wings similar to that of the tobacco budworm. Fifty-six males from larvae collected from *Physalis* sp. had immaculate hind wings and 46 females each had a band on the hind wings. These adults from *Physalis* mated readily and produced fertile eggs from which typical *H. subflexa* larvae developed. Attempts to cross this stock with the tobacco budworm were unsuccessful. Mating was never observed, nor were fertile eggs produced. This is considered ample evidence that the stock from *Physalis* sp. was *H. subflexa* and that the presence of an immaculate hind wing identifies a specimen as a male of this species.

Genitalia of both species were dissected and mounted on slides for studying according to the methods described by Clarke (1941). Results were in general agreement with those reported by McElvare (1941) with only one minor difference. He reported that hair tufts were not present on the eighth abdominal segment of the male tobacco budworm and that *H. subflexa* males had long hair tufts on each side of the anterior end of this segment. Tobacco budworm males examined in this study had hair tufts present but they were located on the posterior end of the eighth abdominal segment.



FIG. 1.—Dorsal setigerous tubercles of first abdominal segment of second instar *H. armigera* showing no spinules.



FIG. 2.—Dorsal setigerous tubercles of first abdominal segment of second instar *H. virescens* showing no spinules.



FIG. 3.—Dorsal setigerous tubercles of first abdominal segment of second instar *H. subflexa* showing no spinules.

FIG. 4.—Dorsal setigerous tubercles of first abdominal segment of third instar *H. armigera* showing no spinules.

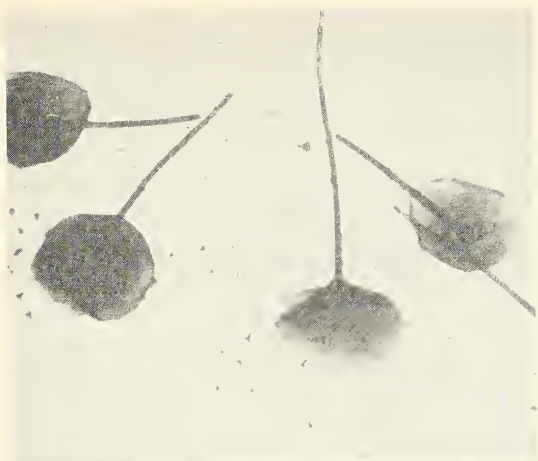


FIG. 5.—Dorsal setigerous tubercles of first abdominal segment of third instar *H. virescens* showing spinules.

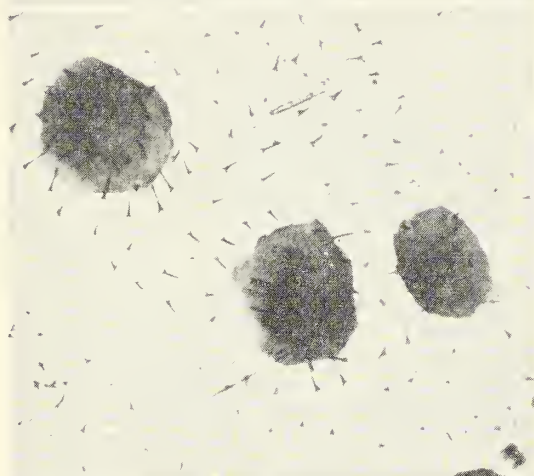


FIG. 6.—Dorsal setigerous tubercles of first abdominal segment of third instar *H. subflexa* showing no spinules.



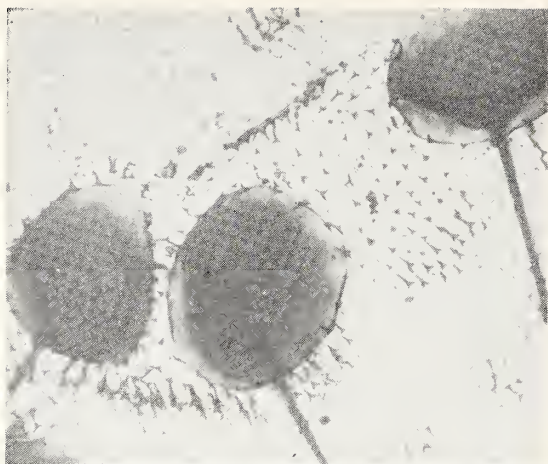


FIG. 7.—Dorsal setigerous tubercles of first abdominal segment of fourth instar *H. armigera* showing no spinules.

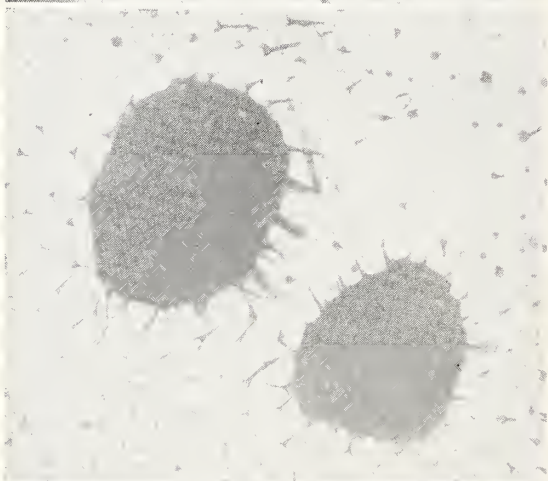


FIG. 8.—Dorsal setigerous tubercles of first abdominal segment of fourth instar *H. virescens* showing spinules.

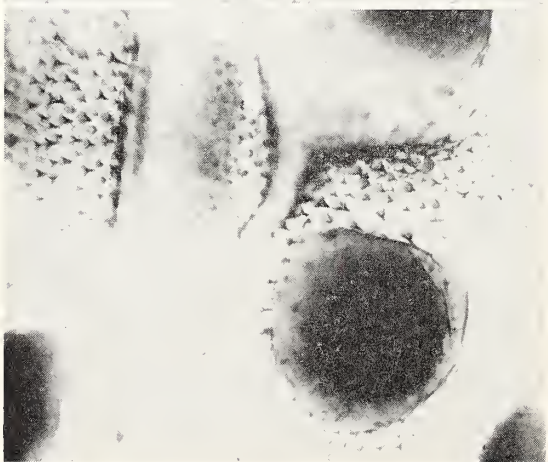


FIG. 9.—Dorsal setigerous tubercles of first abdominal segment of fourth instar *H. subflexa* showing spinules on basal portion.

FIG. 10.—Dorsal setigerous tubercles of first abdominal segment of fifth instar *H. armigera* showing scattered spinules around base.

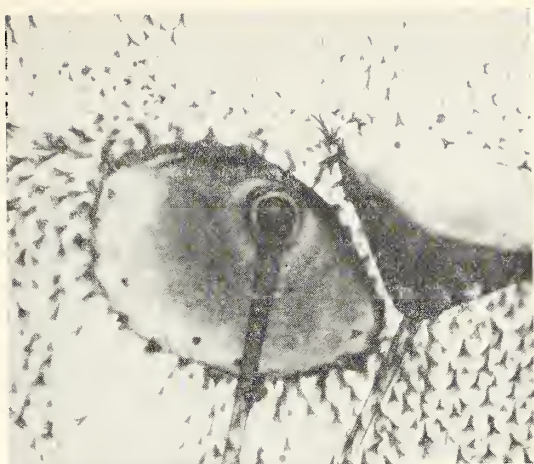


FIG. 11.—Dorsal setigerous tubercles of first abdominal segment of fifth instar *H. virescens* showing spinules covering entire tubercle.

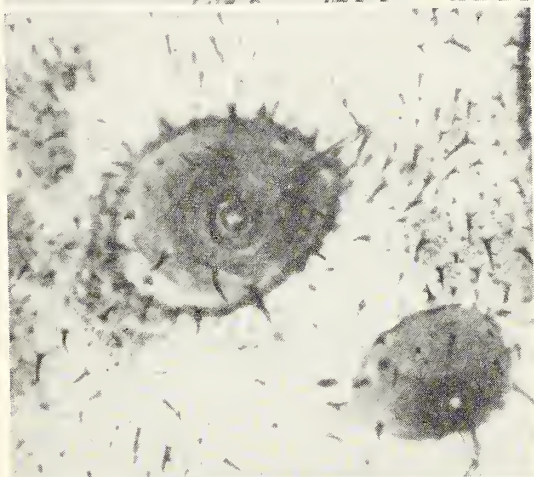
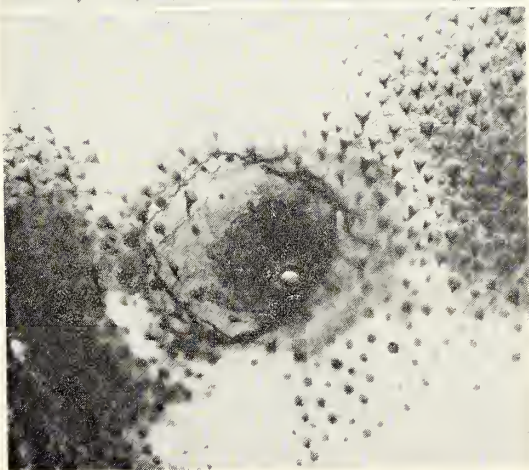


FIG. 12.—Dorsal setigerous tubercles of first abdominal segment of fifth instar *H. subflexa* showing spinules on basal portion.



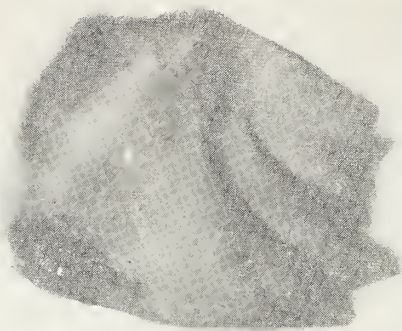


FIG. 13.—Oral view left mandible third instar *H. armigera* showing no basal process.

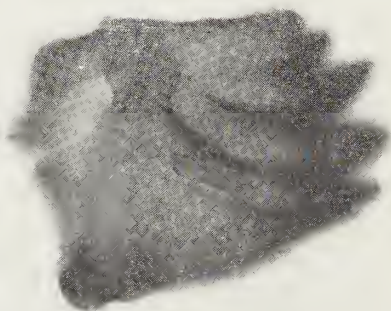


FIG. 14.—Oral view left mandible third instar *H. virescens* showing beginning of basal process.

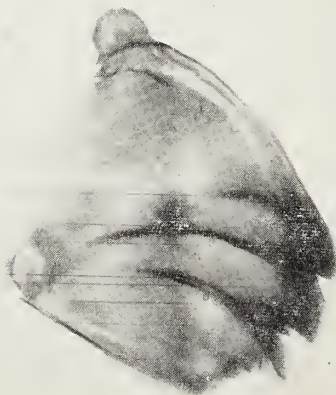


FIG. 15.—Oral view right mandible third instar *H. subflexa* showing no basal process.

FIG. 16.—Oral view right mandible fourth instar *H. armigera* showing no basal process.

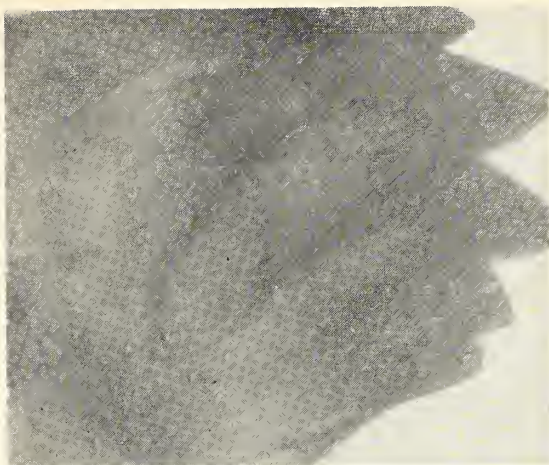


FIG. 17.—Oral view right mandible fourth instar *H. virescens* showing basal process.

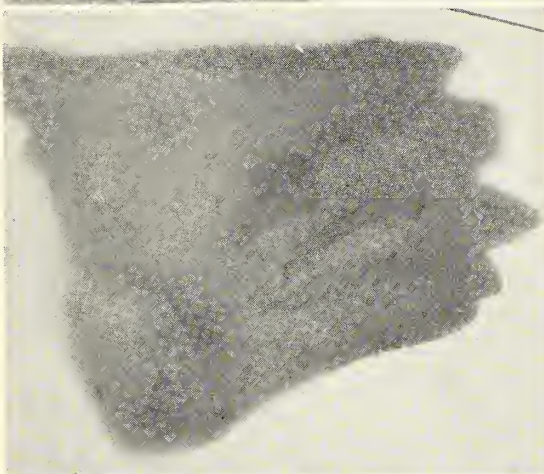


FIG. 18.—Oral view left mandible fourth instar *H. subflexa* showing beginning of basal process.





FIG. 19.—Oral view right mandible fifth instar *H. armigera* showing no basal process.



FIG. 20.—Oral view left mandible fifth instar *H. virescens* showing fully developed basal process.



FIG. 21.—Oral view right mandible fifth instar *H. subflexa* showing basal process.

FIG. 22.—Oral view right mandible sixth instar *H. armigera* showing enlargement of ventral rib.



FIG. 23.—Oral view left mandible sixth instar *H. virescens* showing fully developed basal process.

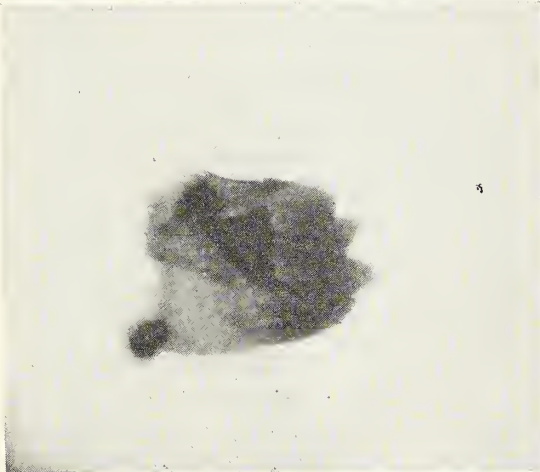


FIG. 24.—Oral view left mandible sixth instar *H. subflexa* showing fully developed basal process.



As McElvare (1941) pointed out, males of the two species can be easily identified by the fact that the harpes of the tobacco budworm are longer and broader than those of *H. subflexa*, thick tufts of hairs arising from the base of the harpes extend past their tips compared to shorter and sparser hair tufts which arise from several locations along the harpes in *H. subflexa*, and the base of the vinculum is broadly rounded compared to that in *H. subflexa* which has a narrow extension ending in a sharp point.

Differences in the ductus bursae of the two species were considered to be satisfactory by McElvare (1941) for distinguishing between the females. Specimens examined in this study showed that the membranous portion of the ductus bursae anterior to the ostium was generally broader and shorter in *H. subflexa* than in the tobacco budworm but this character was so variable it is considered of doubtful taxonomic value.

Taxonomic characters for distinguishing between adults of the three species of *Heliothis* are illustrated in Figures 25 through 29.*



FIG. 25.—Adult specimens of *H. armigera*; male above; female below.

*Photographs by H. Bruce Boudreaux, Louisiana State University.



FIG. 26.—Adult specimens of *H. virescens*; male above; female below.

Discussion of Taxonomic Differences Between the Three Species—

A study of the eggs of the three species showed no differences of taxonomic value.

Reliable differences for identification were found in the larval stages. The differences were in agreement for those described by Crumb (1926) between mandible and microspines on the setigerous tubercles of the tobacco budworm and the bollworm. The description of microspines on the setigerous tubercles of *H. subflexa* given by Peterson (1948), who considered it to be a sub-species of the tobacco budworm, was substantiated. However, his description of the basal process on the mandible appears to be of the fourth instar since it was not toothed. As pointed out above, the mandibular process of this species becomes toothed in later instars and is practically identical with that of the tobacco budworm (Figures 23 and 24). Differences in tubercle pattern surrounding abdominal spiracles as described by McElvare (1941) for the tobacco budworm and *H. subflexa* were not consistent for the specimens studied. From these studies differences between the spiracles of the larva do not appear to be of reliable taxonomic value.



FIG. 27.—Adult specimens of *H. subflexa*; male above; female below.



FIG. 28.—Left: Male genitalia of *H. virescens* showing hair tufts on posterior end of eighth abdominal segment and heavy hair pencils arising from base of harpes. Right: Male genitalia of *H. subflexa* showing hair tufts on anterior end of eighth abdominal segment and sparse hairs arising along harpes.



FIG. 29.—Left: Male genitalia showing large harpes and bluntly rounded vinculum in *H. virescens*. Right: Smaller harpes and pointed vinculum in *H. subflexa*.

Adults were found to have reliable distinguishing characters except for the females of the tobacco budworm and *H. subflexa*. The absence of oblique bands of color on the front wings of the bollworm eliminates the possibility of confusing this species with the other two (Figure 25). However, the adults of the tobacco budworm and *H. subflexa* are very similar. McElvare (1941) described *H. subflexa* as differing from the tobacco budworm by having immaculate hind wings. This was found to be the case in the male only. The hind wings of the female have a band just as do both sexes of the tobacco budworm (Figure 27). Results of this study were in general agreement with his description of differences in female genitalia but these differences were found to be too variable to be relied upon for distinguishing between females of the two species. Comparisons of male genitalia agreed with differences described by McElvare except that hair tufts were found on the posterior end of the eighth abdominal segment of the tobacco budworm where he reported none (Figure 28).

Seasonal History

Seasonal history of the bollworm in relation to cotton has been thoroughly studied by Quaintance and Brues (1905), Bishopp (1929), and Isely (1935). Quaintance and Brues found that five generations developed at Paris, Texas, during 1904. Moths of the first generation emerged April 3 to May 30; the second, June 20 to July 10; the third, July 18 to August 22; the fourth, August 25 to September 25; and the fifth, October 1 to October 5. Bishopp (1929) stated that four or five generations may develop in the South and that the third generation was the destructive one to cotton. The seasonal history of the bollworm and relation of hosts to its seasonal abundance in Arkansas has been sum-

marized by Isely (1935). He reported that larvae could be found from early in May until killing frosts occurred, sometimes as late as November.

Comparatively little attention has been given to the tobacco budworm. Chamberlin and Tenhet (1926) found it to be present at Quincy, Florida, from the first of April until the middle of October, during which period four broods developed. Barber (1937) compared the seasonal histories of the bollworm and tobacco budworm in eastern Georgia. He found that the tobacco budworm differed from the bollworm principally by the relatively brief period of emergence from hibernation and short period of entering hibernation. He found emergence from hibernation and entry into hibernation by the bollworm to take a relatively long time with hibernating pupae always present in the soil. Hibernating pupae of the tobacco budworm were present in the soil only from the first of September to the first of May. Therefore the tobacco budworm was considered more dependent upon a long seasonal distribution of food plants than was the bollworm.

In the present studies larvae of the bollworm were collected in Louisiana during every month of the year except January. Apparently development is continuous, at least at a low level, throughout most years. Clear-cut generations are not apparent and there are at least five per year. Availability of suitable hosts and natural control account to a large extent for variation in abundance of this species. However, definite peaks in activity are evident for at least the first three generations.

The bollworm was abundant during April and May 1952 in Louisiana on lupine (Hasting's white), crimson clover, white clover and in the buds of early corn. One larva was collected February 4 from hairy vetch. Larvae found during April and May are of the first generation.

Corn was the dominant host for larvae of the second generation during June and July. Successive plantings of Golden Bantam sweet corn were made at Baton Rouge at about weekly intervals from February 12 through July 2, 1952. One hundred per cent of the ears from the first planting were infested. Infestation declined to a low of two per cent for the May 7 planting and then increased again. The decrease in infestation for the May 7 planting may be explained by the fact that corn from this planting was in silk during the time when the majority of the second generation was in the pupal stage.

After August 1 silking corn was scarce and the bollworm transferred its attention to cotton, soybean, grain sorghum, alfalfa and other hosts. In early August there was a heavy flight of bollworm moths into cotton. Egg deposition was heavy in cotton during the latter half of August.

The tobacco budworm shows little activity from late October until April. Generations appear to be more distinct than is the case with the bollworm. Adults were taken at Baton Rouge, Louisiana, in late March and early April 1953. Larvae were collected in April 1953 from crimson clover, lupine (Hasting's white) and snapdragon. During 1952 in Louisiana the first generation developed largely on crimson clover. They were abundant on this host in May and scarce or absent on all other hosts examined. The second generation developed almost entirely on cotton. Egg populations on cotton were high about July 1, 1952 in

TABLE 9—Population of eggs of *Heliothis* spp. in cotton of eastern Arkansas during 1952.*

Week ending	Total fields scouted		Fields in area No. 1**		Fields in area No. 2***	
	No.	Per cent having over 5 eggs to 100 terminals	No.	Per cent having over 5 eggs to 100 terminals	No.	Per cent having over 5 eggs to 100 terminals
June 21	995	2.6	39	27.0	77	0
June 28	1018	4.9	46	68.0	77	0
July 5	1035	3.4	46	43.0	77	0
July 12	1030	1.2	39	14.0	77	0
July 19	1040	4.2	49	8.0	77	0
July 26	1020	1.3	53	8.0	77	0
August 2	1037	1.2	56	7.0	77	0
August 9	1006	4.0	50	16.0	77	0
August 16	958	7.2	45	24.0	77	0
August 23	874	12.1	43	46.0	77	0
August 30	610	17.0	30	68.0	53	0
September 6	388	6.2			50	0

* Figures obtained from records of cotton scouts.

** All fields scouted by A. F. Clary, Federal cotton scout, for 6 counties south of Pine Bluff. This is the highest average reported by any scout.

*** All fields scouted by John Carter, a commercial scout, in Ashley County. This represents the lowest average reported by any scout.

eastern Arkansas (Table 9) and during June in Louisiana. This represented the seasonal peak of population of the tobacco budworm and was presumably the second generation. Natural control resulting largely from predation was so effective in both states that few larvae developed except in fields which had been previously treated with insecticides.

After the second generation the numbers of tobacco budworm were so low in 1952 that a definite pattern was not established. There appears to be four and possibly a fifth generation in Louisiana. Cotton is the dominant host until late in the season when *Jacquemontia tamnifolia* becomes important.

Causes of Outbreaks

Factors responsible for outbreaks of the bollworm have been studied by a number of investigators. Quaintance and Brues (1905) listed injury to cotton, by states, in the following order of importance: Texas, Louisiana, Indian Territory, Oklahoma, Mississippi and Arkansas. Injury to

cotton in Alabama, Georgia, Florida and the Carolinas was considered as not ordinarily being very extensive. They suggested that the growing of cotton and corn to the practical exclusion of all other crops in the western portion of the cotton belt was a prime factor in the greater amount of damage caused by the bollworm; by contrast, the eastern portion was highly diversified, having smaller unbroken areas planted to cotton and large acreages of corn interplanted with cowpeas which served to attract the moths and prevent them from moving to cotton. They also pointed out that late planted corn grown for forage and silage in the eastern states served as a trap crop.

Cloudy and rainy weather during late July and August was found to be conducive to severe damage from bollworm by Bishopp (1929), since the soil was moistened allowing more adults to escape from pupal burrows, plant growth was stimulated, and predator and parasite activity was depressed. However, Phillips and Barber (1929) found that more adults were able to emerge from pupal burrows during dry weather.

Reporting on a history of the bollworm in Arkansas since 1911, Isely (1935) stated that there were records of injury every year during the 25-year period covered in the study, with damage reaching outbreak proportions extensive enough to cover several counties in at least nine of these years. He considered a one-crop system as being unfavorable to the bollworm and stated that a combination of legumes and corn made a favorable host combination for developing bollworm outbreaks.

In discussing five outbreaks of bollworms in Arkansas during the period 1925-1940, Lincoln and Isely (1947) stated that four or more counties were involved in each outbreak and that the cotton crop was almost completely destroyed in the center of the outbreak area. Insecticides were not used before or during these outbreaks. Factors correlated with the outbreaks were:

1. An acreage of early corn greater than the cotton acreage.
2. Little late-planted corn.
3. Dry weather which shortened the silking period of corn.

Use of calcium arsenate for boll weevil and leafworm control, which resulted in development of heavy aphid infestations, was considered the predisposing factor for a scattered outbreak covering 11 counties in 1946. No serious bollworm damage was noted in fields in which aphid infestations were not obvious. Unusually large acreages of June-planted corn which came into silk after this outbreak developed were sufficiently attractive to moths that eggs were laid in corn instead of cotton and the outbreak terminated.

It is established that use of calcium arsenate brings on aphid outbreaks by destroying predators. According to Ewing and Ivy (1943) this

may be followed by bollworm outbreaks because populations of predators are reduced; surviving predators feed on the abundant aphids and ignore bollworm eggs and larvae; and the moths may be attracted into the fields to feed on the honeydew secreted by the aphids.

Beginning in 1947 BHC came into general use for boll weevil control. It was soon found that bollworm damage usually occurred following its use. Use of other chlorinated hydrocarbon insecticides alone, namely chlordane, aldrin, dieldrin and heptachlor, is followed by bollworm damage in the same manner as when BHC is used. Since aphid control is usually excellent with BHC, aphid infestations are not a factor in development of bollworm outbreaks following its use. To prevent bollworm damage where these insecticides are used for boll weevil control it has been found necessary to mix them with DDT. As pointed out by Newsom and Smith (1949) these newer insecticides have a more detrimental effect on populations of such bollworm predators as *Geocoris punctipes* and *Orius insidiosus* than calcium arsenate and nicotine mixtures which were formerly used extensively for control of cotton pests.

Use of insecticides for cotton insect control in the two-state area was low in 1947. During late June and early July moderate numbers of *Heliothis* eggs were observed on cotton in northwestern Louisiana and southwestern Arkansas. A damaging bollworm infestation developed in a field at Bossier City, Louisiana, which had been previously treated with a mixture of DDT and BHC for fleahopper control. This was the earliest damaging infestation on record for cotton in the state. Specimens were not collected but comparison with the situation in 1952 suggests that the tobacco budworm was the species involved.

In August and September 1947 there was a bollworm outbreak on soybeans in northeastern Arkansas, soybeans being apparently more attractive than cotton under the droughty conditions prevailing. At this same time there was a heavy local outbreak of bollworm on cotton involving about 10,000 acres near Rayville, Louisiana. This outbreak clearly resulted from biological upset brought on by applications of insecticide beginning about July 20. Applications were made by airplane at irregular intervals and coverage was very poor. Heavy aphid infestation developed which in turn was followed by severe bollworm injury. Damage was confined to fields which had received insecticide applications; untreated fields in the area were not infested.

Insect infestations in cotton were low in Louisiana and Arkansas in 1948 and little insecticide was used on the crop. No bollworm problem developed.

Boll weevil infestations were heavy and use of insecticides reached record highs in both states in 1949 and 1950. In both years local infesta-

tions of bollworms were frequent. In all cases the outbreaks were the obvious result of use of insecticides for boll weevil control. Where recommended timing of applications for boll weevil control was followed, DDT included in mixtures containing BHC or aldrin, and thorough coverage obtained, the bollworm was not a problem. Bollworm damage was usually confined to individual fields where aldrin was used without DDT, early season applications were made without a strict follow-up on bollworm control, or where applications of insecticides were made at improper intervals or poorly applied.

The bollworm outbreak of 1951 was the most widespread one on record in Arkansas. The following sequence of events contributed to the outbreak. A moderate acreage of early-planted corn came up prior to the May drought. Little corn was planted later and most of it was lost to weeds in June and July or to drought in August. After silking had been completed in the latter part of July large numbers of bollworm moths emerged from early corn. Cotton was the only suitable host available. As a result a heavy, continuing outbreak of bollworm developed in cotton from late July until September. The year 1951 differed from a normal year in the scarcity of host plants other than cotton. This was emphasized by the fact that large numbers of eggs were often found on non-succulent cotton which is ordinarily unattractive to bollworm moths.

During this outbreak in 1951 there was a high degree of natural control of eggs and small larvae by a complex of predators consisting of ladybeetles, the bigeyed bug *Geocoris punctipes*, and the insidious flower bug, *Orius insidiosus*. The last-named appeared to be especially effective in Arkansas. Use of insecticides for other pests prior to deposition of bollworm eggs was usually followed by damaging infestations unless control measures were applied. Where no insecticides were used, eggs and small larvae were often present in numbers sufficient to indicate the necessity of insecticidal control measures. Infestations were so heavy in Arkansas it is considered highly probable that the bollworm would have broken through the barrier of natural control over a wide area if no insecticides had been used. The results would have been an outbreak like those of the twenties and thirties. In Louisiana population pressure was lower and outbreaks were more closely correlated with prior use of insecticides than in Arkansas.

In 1952 there were two periods of heavy egg deposition, in June primarily by the tobacco budworm and in late August by the bollworm. The first was completely eradicated by predatism except in a few fields where earlier applications of insecticides had been made. The August population was also subjected to heavy predatism which was usually

sufficient to suppress infestations satisfactorily if insecticides were not used.

None of the various factors involved seems adequate to explain bollworm outbreaks when taken singly. The most important factors contributing to outbreaks on cotton appear to be the following:

1. Biological upsets resulting from the adverse effect of insecticide applications, made for control of other pests, upon the predators and parasites of the bollworm.
2. A succession of host plants favorable to the development of large bollworm populations.
3. Weather conditions favorable to bollworm development.

The following types of bollworm outbreaks have been noted in the nine general and several local outbreaks on record.

1. Natural outbreaks: Heavy populations of moths lay so many eggs on cotton that predators are overwhelmed. These outbreaks cover several counties with all fields in the area being heavily infested. Such outbreaks occur in August and September and the bollworm is the dominant species. Early corn is the host on which most of the moths develop.
2. Outbreaks induced by use of insecticides: (1) Heavy aphid populations brought on by use of insecticides for boll weevil control, especially calcium arsenate, create conditions favorable for bollworm development by furnishing abundant food for the reduced predator population. Honeydew from aphids may attract moths to the field. Outbreaks are local and may be confined to individual fields. These outbreaks also occur in August and September and the bollworm is the dominant species.

(2) Outbreaks induced by use of organic insecticides. Outbreaks of this type are even more localized in extent than those brought about by use of calcium arsenate. They are usually confined to individual fields and may develop from comparatively small numbers of eggs. The principal cause appears to be the almost complete eradication of predators and parasites. When the outbreaks occur early in the fruiting season the tobacco budworm is usually the dominant species. Later in the season the bollworm is usually more abundant than the tobacco budworm.

Natural outbreaks of the tobacco budworm on cotton in the United States appear to be rare. The only authentic record of such an occurrence is that reported by Folsom (1936) as occurring at Tallulah, Louisiana, in 1934. It is suggested that this results from the fact that the tobacco bud-

worm has no second generation host comparable to corn for second generation bollworm and consequently it is unable to develop large populations of moths. Whether the increasing amount of attention being given this species since 1949 indicates that it is becoming more important as a cotton pest, or whether the increasing amount of attention results from more entomologists having learned to recognize it, cannot be established at this time. However, two comparatively recent developments which may result in an increase in importance of this species as a cotton pest should be mentioned. First, greater acreages of favorable first generation hosts, especially crimson clover and white clover, are being planted in the area. Secondly, use of insecticides on cotton early in the season destroys the predators which normally suppress development of the second generation. This has allowed cotton to become a favorable second generation host and where practiced extensively may result in development of large populations of moths similar to numbers of second generation bollworm developing on corn.

Insecticidal Control

The report of the Conference of Cotton Entomologists (Third Memphis Report, 1952) states: "The most effective insecticide for bollworm control is DDT. For heavy bollworm infestations it should be applied at the rate of 1 to 1.5 pounds of the technical material per acre in a 10 per cent dust or concentrated spray. DDT may be used in mixtures with other insecticides when other insects as well as bollworms require control. It is compatible with lime-free calcium arsenate, but not with regular calcium arsenate. Bollworms usually are controlled where 0.5 pounds or more of DDT per acre is applied with BHC, aldrin, chlordane, dieldrin, or heptachlor in the regular schedule for boll weevil control.

"Toxaphene, at the rate of 2 to 4 pounds of the technical material per acre, is the next most effective insecticide against bollworms. This may be applied as a 20 per cent dust or as a spray. The addition of DDT to toxaphene dust or spray greatly improves the effectiveness of this insecticide for bollworm control."

Recommendations of the Arkansas Agricultural Extension Service state: "Damaging outbreaks of bollworm usually occur from the middle of July through August. Inspect terminal growth for bollworm eggs and small worms at least once a week, or each time the cotton is scouted for weevils. Count 100 terminals in a field. If an average of 4 or 5 small worms, plus additional eggs, are found to 100 terminals, it is usually time to apply insecticides.

"In fields that have not received any insecticides, treatment may be delayed a few days to give beneficial insects a chance to destroy an in-

festation. It was demonstrated in 1952 that beneficial insects are capable of controlling heavy outbreaks of bollworms. Careful scouting is required to stop an outbreak before it gets through to the larger squares and bolls. Larger worms are difficult to control and require heavier applications of insecticides.

"Insecticide applications should be made at intervals not to exceed 5 days, and continued until infestations are brought under control. At least three applications are usually necessary."

These recommendations were developed from results of field tests conducted by entomologists throughout the cotton belt on populations consisting of the bollworm or mixtures of bollworm and tobacco budworm.

Information on the relative susceptibility of the two species to insecticides is unavailable. Therefore, investigations were conducted in the laboratory to determine their relative susceptibility to DDT, toxaphene, and endrin. Field tests were conducted to determine the effectiveness of new insecticides and to try to develop measures satisfactory for the control of large larvae.

Comparative Tests with the Bollworm and the Tobacco Budworm—Cultures of both species were maintained in the laboratory under conditions of uncontrolled temperature and humidity to supply larvae used in these tests. Methods described previously were employed.

In order to study contact effect, one milliliter of acetone in which the desired amount of DDT was dissolved was applied to the bottoms of petri dishes 100 millimeters in diameter. The dish was swirled about to secure thorough coverage after which the acetone was allowed to evaporate. Third instar larvae were placed in the treated petri dish and supplied with food consisting of cotton leaves cut into square centimeter pieces. Each replicate consisted of three treated dishes with one to four larvae each.

Four dosages and five or six replications were used. Observations were made at 12-hour intervals for 48 hours. Per cent kill was calculated according to Abbott's formula (1925). Results are presented in Table 10.

TABLE 10—Comparison of the susceptibility of the bollworm and tobacco budworm to DDT as a contact insecticide. Baton Rouge, Louisiana, 1952.

Dosage in micrograms per dish	Per Cent Control							
	12 hours		24 hours		36 hours		48 hours	
	Bollworm	Budworm	Bollworm	Budworm	Bollworm	Budworm	Bollworm	Budworm
10	30.0	18.2	84.5	49.0	97.8	68.8	98.0	68.8
20	42.6	15.6	91.7	57.0	95.8	71.6	100.0	77.2
30	46.2	16.0	100.0	54.0	100.0	74.0	100.0	80.2
40	64.8	16.4	98.7	65.2	100.0	81.8	100.0	86.3
Average	45.9	16.6	93.7	56.3	98.4	74.1	99.5	78.1

Results of these tests showed the bollworm to be much more susceptible to DDT than the tobacco budworm under the conditions described. The difference was highly significant when analyzed statistically.

Toxaphene and endrin were also tested with this technique but both materials demonstrated fumigation as well as contact effects.

The relative susceptibility of the two species to DDT and toxaphene as stomach poisons was studied by feeding measured dosages of the insecticides to individual larvae by a leaf sandwich technique modified from that described by Ellisor and Floyd (1938). A dusting chamber and air pump similar to those described by Gaines and Dean (1949) were used to apply the insecticides to the leaf sections.

One hundred and seventy-nine bollworm larvae and 214 tobacco budworm larvae were fed individual dosages in this manner. These larvae were observed until a portion of the sandwich had been consumed, after which they were placed on fresh food for a 48-hour observation period. The median lethal dose of DDT, calculated according to methods described by Bliss (1938), was 0.2903 milligrams per gram of body weight for the bollworm and 1.5700 milligrams per gram of body weight for the tobacco budworm. The difference in median lethal dose for the two species was highly significant when analyzed statistically.

Toxaphene was equally toxic to both species. The median lethal dosage for the bollworm was found to be 0.1981 and for the tobacco budworm 0.2197 milligrams per gram of body weight. Forty-nine bollworm larvae and 67 tobacco budworm larvae were used in the test.

Total contact and stomach poison effects were measured by treating cotton terminals and confining larvae to them in small, screen cages. Insecticides were applied as dusts by means of a laboratory dusting chamber. Five per cent DDT, BHC-DDT-sulphur mixture (commercial 3-5-40), and toxaphene-sulphur mixture (commercial 20-40) were compared. Five fourth instar larvae were used in each cage and there were six or eight replications. Tests were run under conditions of uncontrolled temperature and humidity existing in the laboratory.

In these small cage tests 5 per cent DDT was significantly more toxic to the bollworm than to the tobacco budworm. Toxaphene and the BHC-DDT-sulphur mixture were equally toxic to both species. The BHC-DDT-sulphur mixture was highly effective and rapid in its action. Toxaphene was slow-acting but gave good kill after 48 hours, although not at 24 hours (Table 11).

Field Tests to Control Small Bollworms—Heavy infestations prevalent in some areas of both states during 1951 and 1952 allowed field tests to be made of the effectiveness of various insecticides and mixtures for control of bollworms on cotton. The bollworm was the dominant species

TABLE 11—Comparison of the toxicities of DDT (5%), BHC-DDT-sulphur (3-5-40), and toxaphene-sulphur (20-40) dusts to the bollworm and tobacco budworm. Baton Rouge, Louisiana, 1952.

Treatment	Per cent control			
	24 hours		48 hours	
	Bollworm	Tobacco budworm	Bollworm	Tobacco budworm
Test No. 1				
5% DDT at 10 lbs. per acre	47.2	17.3	93.3	31.5
5% DDT at 20 lbs. per acre	85.0	73.3	100.0	93.3
Test No. 2				
5% DDT at 5 lbs. per acre	34.4	5.3	69.3	18.1
5% DDT at 10 lbs. per acre	57.3	31.6	91.8	76.9
5% DDT at 15 lbs. per acre	71.3	45.6	100.0	91.9
Test No. 3				
5% DDT at 10 lbs. per acre	63.3	25.0	100.0	79.0
3-7 40 at 10 lbs. per acre	83.3	86.7	96.7	100.0
20-40 at 10 lbs. per acre	33.3	20.0	90.0	82.2

in all the tests conducted. However, the tobacco budworm made up 30 per cent of the population in a test at Monroe, Louisiana, in 1951.

In this test at Monroe a heavy infestation developed during August in a field of late-planted cotton. Six materials, applied as spray concentrates at the rate of 7 gallons of finished spray per acre with a 6-row power sprayer, were compared. Six applications were made between August 6 and September 4. Treatments were replicated three times in randomized blocks. Plots were 12 rows wide and of sufficient length to comprise 0.6 acre each. Effectiveness of the materials was determined by counting the number of injured squares and the number of larvae per 100 squares in each plot on six dates between August 9 and September 12 and by counting the number of injured bolls per 100 inspected on four dates between August 23 and September 12. Boll weevil damage was negligible in the test. Yield was obtained by picking one-tenth of an acre area in each plot. Results are summarized in Table 12.

TABLE 12—Comparison of insecticides for control of *Heliothis* on cotton. Monroe, Louisiana, 1951.

Treatment	Per cent squares injured	No. larvae per 100 squares	Per cent bolls injured	Yield in pounds seed cotton per acre
1. Endrin at 0.14 lb/A	12.10	2.99	15.1	833
2. Toxaphene at 2.64 lb/A	12.28	2.48	13.55	970
3. Isodrin at 0.14 lb/A	14.98	2.05	21.48	573
4. EPN at 1.21 lb/A	6.03	0.83	10.50	1363
5. Dieldrin at 0.17 lb/A plus DDT at 0.70 lb/A	5.82	1.25	7.58	1363
6. Heptachlor at 0.22 lb/A plus DDT at 0.71 lb/A	6.83	1.00	8.50	1263
L. D. 0.05	3.05	....	7.86	176

Two additional tests in Louisiana and one in Arkansas were conducted in 1952. Six insecticide mixtures were compared for control of an infestation of boll weevil and bollworm at Bunkie, Louisiana. Neither the boll weevil nor the bollworm infestation developed beyond moderate proportions during the season. All materials were applied as spray concentrate at the rate of 2 gallons finished spray per acre. Applications were made by airplane. Nine applications were made between July 19 and August 28. Treatments were replicated three times in randomized blocks. Plots were 32 rows wide and of sufficient length to comprise 4 acres each. Effectiveness of the materials was determined by the methods described above. Results are summarized in Table 13.

TABLE 13—Comparison of insecticides for control of *Heliothis* on cotton. Bunkie, Louisiana, 1952.

Treatment	Per cent squares injured		Per cent bolls injured	Yield in pounds seed cotton per acre
	Boll weevil	Bollworm		
1. Endrin at 0.20 lb/A	10.4	2.5	1.3	2348
2. Methyl homolog of parathion at 0.28 lb/A	26.4	4.7	9.3	1753
3. Heptachlor at 0.33 lb/A plus DDT at 0.67 lb/A	9.9	2.3	0.3	2124
4. Dieldrin at 0.15 lb/A plus DDT at 0.53 lb/A	9.0	2.2	2.3	2090
5. BHC at 0.31 lb. gamma isomer per acre plus DDT at 0.52 lb/A	12.7	2.1	1.3	2017
6. Toxaphene at 2.0 lb/A*	21.5	3.1	4.7	2014
L. D. 0.05	6.97	....	4.9	.....

*DDT added at rate of 0.50 lb. per acre in last application.

A similar test in which six insecticide mixtures were compared for control of a mixed boll weevil and bollworm infestation was conducted at Shreveport, Louisiana. Treatments were replicated five times in randomized blocks. All materials were applied as concentrated sprays. Application was by airplane at the rate of 2 gallons of total spray mixture per acre in three replicates and by a 6-row, tractor-mounted ground sprayer at the rate of 3 gallons of spray mixture per acre in two replicates. Plots were 20 rows wide and of sufficient length to comprise 1 to 1.6 acres in the three replicates treated by airplane and 12 rows wide and of sufficient length to comprise 2 acres in the two replicates treated by ground equipment. One replicate received 11 applications between July 8 and August 23; two replicates received 8 applications between July 14 and August 16; and two replicates received 4 applications between August 14 and August 30. A moderate boll weevil infestation developed in three of the replicates but was negligible in the other two; heavy bollworm infestations developed in all replicates. Results of this test are summarized in Table 14.

TABLE 14—Comparison of insecticides for control of *Heliothis* on cotton. Shreveport, Louisiana, 1952.

Treatment	Per cent squares injured by boll weevil	Per cent bolls injured by bollworm	Yield in lbs. seed cotton per acre
1. Endrin at 0.20 lb/A	12.88	4.76	2175
2. Methyl homolog of parathion at 0.25 lb/A	20.26	13.56	2002
3. Heptachlor at 0.25 lb/A plus DDT at 0.50 lb/A*	7.68	3.32	2343
4. Dieldrin at 0.15 lb/A plus DDT at 0.50 lb. per A*	8.16	3.30	2373
5. BHC at 0.30 lb. gamma isomer/A plus DDT at 0.50 lb/A	10.52	5.32	2250
6. Toxaphene at 2.0 lb/A	17.42	5.96	2251
L. D. 0.05	6.28	3.56	.....

*Applied without DDT until first week of August.

Results of these tests showed that DDT, toxaphene and endrin were effective insecticides for control of bollworm.

Under conditions of severe bollworm infestation at Monroe in 1951, it was necessary to increase the rate of application of DDT in the insecticide mixtures to 0.7 pound technical to obtain satisfactory control. In this same test EPN at the rate of 1.21 pounds technical gave control equal to DDT. Endrin failed to satisfactorily control the mixed infestation when applied at the rate of 0.14 pound technical material per acre. Toxaphene was not as effective as DDT and EPN.

At both locations in 1952 DDT at 0.5 to 0.67 pound per acre and endrin at 0.2 pound per acre gave control of moderate to heavy bollworm infestations. Toxaphene was less effective. The methyl homolog of parathion failed to satisfactorily control bollworm in both tests and was also inferior for boll weevil control.

In a test at Marianna, Arkansas, drouth damage was so severe that the performance of the insecticides tested had to be based on damage to squares only. Under conditions of a moderate infestation and using square damage as the criterion of effectiveness, the following treatments gave good control:

DDT at 0.5 pound per acre as a spray or dust when mixed with

heptachlor, BHC, methyl homolog of parathion, or dieldrin.

Toxaphene spray or dust at 2 pounds actual toxaphene per acre.

EPN spray at 0.5 pound actual EPN per acre.

Dieldrin dust, 5%, at 0.5 pound actual dieldrin per acre.

Endrin spray at 0.25 pound actual endrin per acre.

Inferior control was obtained with calcium arsenate at 8-10 pounds per acre, with 2½ per cent dieldrin dust to give 0.25 pound dieldrin per acre, with an organic arsenical compound at 0.5 pound per acre, with sodium fluosilicate at 2.5 pounds per acre, and with aldrin-DDT dust.

The aldrin-DDT dust is equivalent to several effective mixtures of DDT with other insecticides and no explanation is available to account for its failure to perform satisfactorily.

Control of Large Bollworms—In order to give natural control agents full opportunity to control infestations it would be desirable to delay beginning of insecticide applications until bollworm larvae are partly grown. Such a procedure would make determination of infestation levels and timing of insecticide applications much easier for the grower. However, such a delay in application is not practical because of difficulties of controlling large larvae with insecticides and methods of application now available.

Lincoln and Williams (1952) reported results of three experiments in Arkansas in 1951 designed to explore the possibilities of "knocking out" established infestations of large bollworms. In these studies the most effective control was obtained with 10 per cent DDT dust applied at the rate of approximately 20 pounds per acre. This treatment gave an average of 57 per cent control in three experiments, which was considered to be unsatisfactory.

Three tests were conducted on control of large bollworm larvae in Arkansas in 1952. The first test was conducted on cotton about five feet high with tangled, interlocking branches. Plots were 1/10 acre in size and unreplicated. Insecticides were applied September 6 and 7 using hand-crank dusters and a conventional low-gallonage sprayer with three nozzles per row. Effectiveness of the insecticides was determined by examining entire plants for larvae. A crew of three or seven men worked in each plot for 30 minutes. Counts were made September 10. Results are summarized in Table 15.

TABLE 15—Comparison of the effectiveness of insecticides for control of large bollworm larvae. Jackson County, Arkansas, 1952.

Treatment	Number larvae found		
	Newly-hatched	Late first and second instar	Third and subsequent instars
1. 50% DDT dust at 15 lbs. per acre	2	1	0
2. Endrin spray at 1.2 lbs. per acre	2*	0*	6*
3. 3-10-40 dust at 50 lbs. per acre	2*	4*	6*
4. EPN spray at 1 lb. per acre	4*	0*	10*
5. 15% toxaphene plus 5% DDT at 37 lbs. per acre	14*	2*	10*
6. 15% toxaphene plus 5% DDT at 25 lbs. per acre	11	1	3
7. 3-10-40 dust at 27 lbs. per acre	15	3	7
8. DDT spray at 2 lbs. per acre	8	7	7
9. 2% isodrin dust at 20 lbs. per acre	21	5	4
10. Check	20*	56*	42*

*Plots counted by three men and figures given are twice the number actually found in order to make them more nearly comparable to those obtained by seven men.

The second test was conducted on cotton two to five feet high in a field having a poor stand. Plots were 1/12 acre in size. Insecticides were applied September 7 with hand-crank dusters. Treatments were replicated twice in randomized blocks. Two men counted all the larvae that could be found in a period of 20 minutes in each plot. Counts were made September 10. Most of the larvae found were in the third or later instars. Results are given in Table 16.

TABLE 16—Comparison of the effectiveness of insecticides for control of large bollworm larvae. Poinsett County, Arkansas, 1952.

Treatment	Number larvae found		
	Replicate 1	Replicate 2	Total
1. 3-10-40 dust at 25 lbs. per acre*	0	4	4
2. 3-10-40 dust at 20 lbs. per acre	6	3	9
3. 3-10-40 dust at 10 lbs. per acre	4	4	8
4. 15% toxaphene plus 5% DDT at 20 lbs. per acre	2	7	9
5. 2% isodrin dust at 20 lbs. per acre	9	9	18
6. Check	14	—	—

*Two spouts per row for more thorough coverage.

In the third test 3-10-40 dust was applied by airplane with the swaths at right angles to the rows. Application was made September 18. The insecticide was applied at two rates, 15-20 pounds per acre and 30-40 pounds per acre. Effectiveness of treatments was determined by counting 240 forms (squares, blooms and young bolls) in each treatment and check September 22. In making these counts five forms were examined on each row for 48 rows while following the dusted swath. The larvae found were in the third or later instars. Results are given in Table 17.

TABLE 17—Comparison of 3-10-40 dust at two rates of application for control of large bollworm larvae. Lincoln County, Arkansas, 1952.

Treatment	Number of larvae found
1. Check	48
2. 3-10-40 dust at 15-20 pounds per acre	24
3. 3-10-40 dust at 30-40 pounds per acre	2

Results of these tests show that the effectiveness of DDT for control of large bollworm larvae was correlated with rate of application. Control improved as dosages were raised to seven pounds actual DDT per acre. At commercial rates of application, 1 to 2 pounds per acre, control ranged from 50 to 80 per cent. A mixture of 15 per cent toxaphene and 5 per cent DDT was equal to 10 per cent DDT dust. Endrin gave outstandingly effective results in the one test where it was included. Applied as a spray at the rate of 0.5 pound per acre, it was superior to DDT at 2 pounds per acre applied in the same manner. In fact, it was as effective as 5 to 7 pounds of actual DDT per acre applied as a dust. EPN at the

rate of 1 pound of the technical material per acre gave good results in one trial, ranking above all treatments except endrin and high dosages of DDT. Isodrin was the poorest material tested, a 2 per cent dust applied at the rate of 20 pounds per acre ranking last in two tests. Results of these tests offer further proof of the difficulty of controlling bollworm larvae after they have reached the third or later instars.

Summary

The bollworm, *Heliothis armigera* (Hbn.), and the tobacco budworm, *H. virescens* (F.), cause similar injury to cotton. Adults of these two species can be readily distinguished. The color in bollworm adults varies from a light brown with a greenish cast in the male to a deep reddish-brown in the female. Forewings of the tobacco budworm are olive green in color with three oblique white lines. The adults are generally smaller than the bollworm.

Larvae of the two species are remarkably similar in appearance. No characters have been discovered by which first and second instar larvae can be separated, but in the third instar microspines appear on the setigerous tubercles of abdominal segments one, two and eight and a basal process appears on the mandibles of the tobacco budworm which differentiates it from the bollworm. Larvae of the bollworm possess neither of these characters except in some cases in late instar larvae a few microspines may appear at the base of setigerous tubercles.

A third species, *H. subflexa*, is very similar to the tobacco budworm in appearance. Males of the two species differ by the presence of a border on the hind wings of the tobacco budworm whereas the hind wings of male *H. subflexa* are immaculate. Females of the two species are practically identical. Characteristic differences in internal genitalia of the two species are illustrated. Larvae of *H. subflexa* may be distinguished from those of the tobacco budworm by the distribution of the microspines on the setigerous tubercles which are limited to the basal half. This species was collected only from ground cherry, *Physalis* sp., and appears to be of no economic importance.

Life history studies showed the tobacco budworm to have a life cycle of 32 days when reared on a favorable host such as cotton at a temperature of about 82 degrees F. Time required for completion of the different stages was as follows: Incubation period, 3 days; larval feeding period, 13 days; combined pre-pupal and pupal period, 13 days; and preoviposition period, 3 days. At low temperatures more time was required for development. Unfavorable hosts lengthened the larval feeding period. These results are closely comparable to published data for the bollworm. When reared simultaneously tobacco budworm larvae developed more rapidly on cotton bolls than did bollworm larvae.

The maximum oviposition period was 27 days and the maximum number of eggs deposited by one individual was 1025 for the tobacco budworm. The number of eggs laid was very variable and was influenced by temperature and larval hosts. The number of eggs deposited by an individual was directly correlated with size as measured by pupal weight.

The bollworm usually has five generations each year with a considerable amount of overlapping between generations. During years with mild winters larvae of this species are present throughout the year in Louisiana. It has a wide variety of hosts. The first generation develops on winter legumes and in the buds of corn. The second depends on corn ears, and a great build-up in population usually occurs during this generation. Third and fourth generations prefer late corn as a host but, in its absence, attack a variety of crop plants, particularly cotton, sorghum, soybeans and alfalfa.

The tobacco budworm appears to have four and a partial fifth generation with less overlapping of generations than in the bollworm. Its host range among cultivated crops is also more restricted. The first generation develops on winter legumes. Crimson clover is a favorable first generation host for this species and appears to be responsible for the build-up of comparatively large populations. The second, third and fourth generations are largely dependent on cotton, although occasional individuals are found on a variety of wild and cultivated plants. The peak of abundance on cotton occurs during June and early July. Heavy populations sometimes occur in Louisiana during late September and early October on second-growth cotton foliage. *Jacquemontia tamnifolia* is an important wild host late in the season.

Although the tobacco budworm was found to have a restricted range of cultivated hosts in the field, it developed satisfactorily on a variety of such plants in the laboratory. For example, corn in the early dough stage and sorghum heads were found to be excellent laboratory hosts but the tobacco budworm was never collected from them in the field.

The most striking difference in the seasonal development of the bollworm and tobacco budworm occurs during the second generation when corn supplies the bollworm with an excellent host for building up tremendous populations. The tobacco budworm does not attack corn and is subjected to such heavy predatism on cotton that large populations do not normally develop.

A large acreage of early corn and little late corn is an important factor which creates conditions favorable to general outbreaks of the bollworm in late summer. Drouth, resulting in adverse growing conditions for other hosts, may force comparatively more moths to deposit eggs on cotton than would occur under normal conditions. Use of in-

secticides also creates conditions favorable for bollworm outbreaks by decimating the predator population and sometimes by causing a build-up in aphid population which competes with bollworm eggs and larvae as a source of food for the predator complex. More general use of insecticides and a shift to synthetic organic insecticides that are more destructive to the predator population have contributed to the increasing importance of the bollworm as a cotton pest in recent years. Outbreaks of the tobacco budworm appear to be almost entirely induced by use of insecticides resulting in biological upsets.

Laboratory insecticide tests showed the tobacco budworm to be less susceptible than the bollworm to DDT. Both species were equally susceptible to toxaphene.

Results of field tests timed to control hatching larvae showed DDT to be the most effective proven insecticide for control of the bollworm. It was effective at 0.5 to 1.5 pounds actual DDT to the acre per application depending on severity of infestation and interval between applications. DDT was effective as dusts or concentrate sprays applied by either ground or aerial equipment. Uniform coverage of terminal growth was found to be essential for effective control.

Toxaphene at the rate of 2 pounds or more actual toxaphene to the acre was effective but less so than DDT. Endrin at dosages of 0.2 pound or more to the acre gave excellent results. This comparatively new insecticide shows much promise for the control of *Heliothis* species.

Bollworm larvae in the third and subsequent instars were found to be very difficult to control. Applications should always be timed to control small larvae. As an emergency treatment for the control of large larvae applications of DDT at the rate of 5 to 7 pounds per acre or endrin at 0.5 pound per acre were effective.

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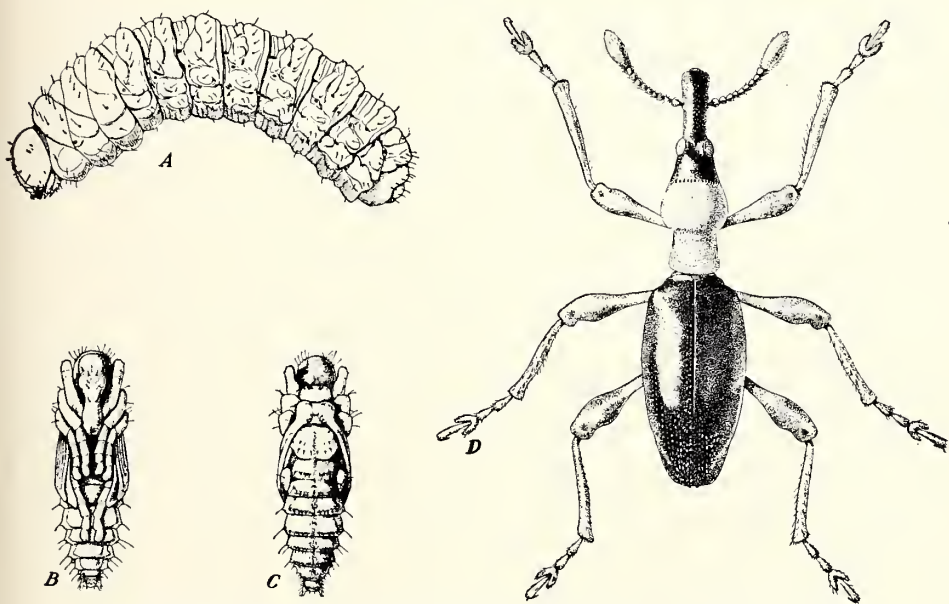
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The Biology of the Sweet Potato Weevil

By

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The sweet potato weevil: *A*, larva; *B*, pupa, under side; *C*, pupa, upper side; *D*, adult female. (All about 9 times natural size.)

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The Biology of the Sweet Potato Weevil

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The sweet potato weevil (*Cylas formicarius elegantulus* (Sum.)) is the most destructive insect enemy of the sweet potato crop in the United States. It lives only on the sweet potato and other plants of the genus *Ipomoea* and is believed to be a native of Asia. In the United States it has been mostly confined to the coastal sections, where it has spread principally by transportation of infested sweet potatoes from farm to farm and from locality to locality.

Studies on the biology of the sweet potato weevil were begun in St. Landry and East Baton Rouge parishes of Louisiana in 1937 to obtain information that would aid the state and federal projects on the control and prevention of spread of the insect. The primary objective was to obtain detailed information on the importance of such phases of the biology of the insect as flight, longevity, and host-plant preference in perpetuating infestations of the insect. The purpose of this bulletin is to summarize the results of these studies from 1937 to 1949, inclusive. Results of investigations at the same time on control with insecticides will be published elsewhere.

NATURE OF DAMAGE

Most of the damage to the sweet potato crop by the sweet potato weevil is through infestation of the potatoes.⁵ The larvae also tunnel the vines, but this injury does not cause appreciable losses. Adults feed on the potatoes and lay eggs directly upon them (Fig. 1 *A*) when they are accessible. Feeding and egg punctures and emergence holes mar the appearance of the potatoes, and may even cause them to become dry or shriveled (Fig. 1 *B*). The larvae burrow through the potatoes, rendering them unfit for use (Fig. 2). Even moderate infestation may impart a bitter taste.

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⁵The term "potato," as used throughout this manuscript, refers to the edible roots of the sweet potato plant.

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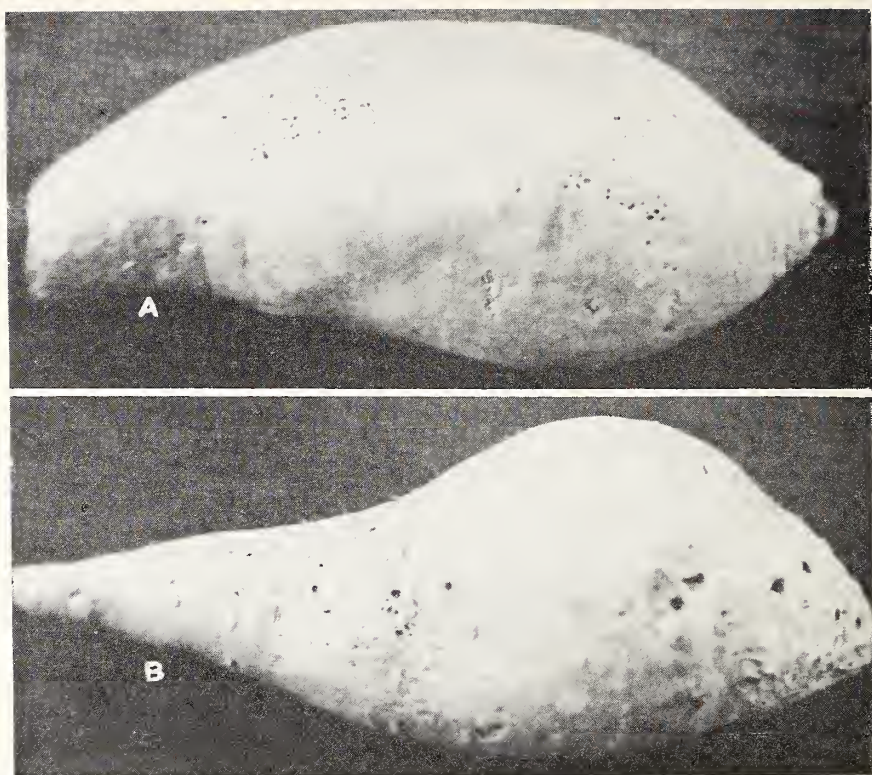


Figure 1. Sweet potatoes showing feeding and egg punctures of adult sweet potato weevils: *A*, Lightly infested; *B*, heavily infested.

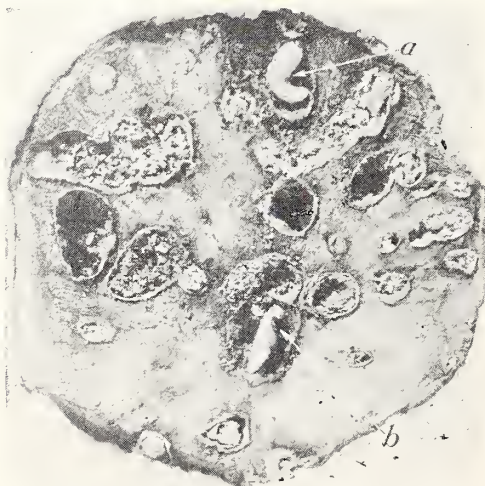


Figure 2.—Cross section of sweet potato showing larval tunneling, with a sweet potato weevil larva (*a*) and a pupa (*b*) in the tunnels. (Slightly less than twice natural size.)

In addition to direct damage to the crop, the presence of the sweet potato weevil in certain areas has caused other losses. Well-established seed and plant industries, as well as growers of sweet potatoes for food, who had the misfortune to be located in areas infested by this insect, have been subjected to losses due to decreased demand for their products. The establishment of quarantines to permit the safe movement of certified sweet potatoes from the infested areas has been beneficial in preserving markets for

the crop produced in these areas and in reducing the spread of the insect.

HISTORY AND DISTRIBUTION

The sweet potato weevil was first described in 1792-94 by Fabricius (4), who called it *Brentus formicarius*, from specimens evidently from Trenquebar, India. Later he classified it as *Attelabus formicarius*, but after a time he gave it its original designation of *Brentus formicarius*. This classification remained undisturbed until after the erection of the genus *Cylas*, when Olivier (9) placed the species in this genus. Summers (13) in 1875 described this weevil as *Otidocephalus elegantulus*. Le Conte and Horn (6) stated that this is synonymous with *Cylas formicarius*. Pierce (10) in 1918 published a detailed description and key for separating species of *Cylas*. Specialists in the United States National Museum in 1941 decided that the correct designation for this insect should be *Cylas formicarius* subspecies *elegantulus* Sum., and this name still applies. Newell (7) referred to the insect under the common name "sweet potato root weevil." Comstock (2), Hinds (5), and Conradi (3) called it "the sweetpotato root borer," but "sweet potato weevil" is now generally accepted as the common name.

It was first recognized as an economic pest in 1857 by Nietner (8), who reported the ravages of the pest in Ceylon in 1856. He stated that in one locality practically the entire crop of sweet potatoes on hundreds of acres was destroyed. Between 1792 and 1856 it was reported from various parts of Asia and Africa and from the outlying islands of both continents. It has also been reported in the West Indies, South America, and Mexico.

The sweet potato weevil was first discovered in the United States near New Orleans, La., in 1875. Its next appearance was near Manatee, on the west coast of Florida, in 1878, and it was found in Harris County, Tex., in 1890. The source of the first introduction of the insect into this country is not known, but it is thought to be the West Indies, since these widely separated localities are ports of entry for West Indian trade. This pest was discovered in Mississippi and Georgia in 1917, in Alabama in 1918, and in Oklahoma in 1922.

Its distribution now covers a large part of Florida, a large number of counties of southern and eastern Texas, the lower half of Louisiana, the coastal counties of Mississippi and Alabama, a few counties of southern and southeastern Georgia, and Charleston County, S. C. In Oklahoma, where it has been reported on several occasions, it was apparently eradicated before obtaining a permanent foothold.

Just as the original infestations in Louisiana, Florida, and Texas are attributed to the shipping of sweet potatoes from the West Indies, a

great part of the distribution along the Gulf coast may be attributed to coastwise shipping and to commerce. The presence of the weevil in Adams County, Miss., Caddo and Bossier parishes, La., Stephens County, Okla., and several counties in northeastern Texas was directly traceable to the movement of infested seed or plants into these areas.

In the United States many publications have been issued on the sweet potato weevil. Comstock (2) in 1879 recorded it from Florida and described its life history. He stated, "It seems to threaten the destruction of the sweet potato crop in this country." The more important early descriptions of the life history of the insect, its occurrence and control measures were made by Conradi (3) in 1907, by Chittenden (1) in 1919, and by Smith (12) and Reinhard (11) in 1923.

Damage by the insect in 1917 was reported by Chittenden (1) to be 20 per cent of the Texas crop, or \$1,800,000, 12 per cent of the Louisiana crop, or \$600,000, and 10 per cent of the Florida crop, or \$400,000. Newell (7) estimated the damage to the Florida crop in 1917 at 30 to 50 per cent in many parts of the state, and to be \$3,500,000 over the entire infested area of the Southern States.

Weevil injury to the sweet potato crop in Louisiana was estimated by growers and dealers in St. Landry Parish to average about 12.5 per cent per year prior to the Second World War. This loss was in an area where systematic cultural control measures were employed every year. These growers and dealers estimated that, without these suppressive measures, the industry would be destroyed within 3 years. During recent years the annual loss in the United States is estimated at approximately \$5,000,000.

DESCRIPTION OF THE STAGES

Egg

The egg is creamy-white, broadly oval, and narrowed at the attached end. It is almost uniformly convex in outline. The surface appears smooth and unpolished, but under the microscope shows slight granulation. The surface shows no distinct sculpturing, but there is an indication of imperfect facets. The shell is very thin and fragile. The length is about one-fortieth and the thickness about one-fiftieth of an inch.

Larva

The newly hatched larva is nearly pure white, but when mature (Cover illustration) it appears ivory white. It is a legless grub, having a very thin body wall through which the intestinal contents and the fatty tissues can be seen. The head is light brown, and the mouth parts are dark brown. The average widths of the head capsules of the three

stages examined were as follows: First instar 0.29 mm., second instar 0.43 mm., and the third instar 0.75 mm. The full-grown larva is about three-eighths of an inch long. It is cylindrical, robust, nearly uniform in diameter, and the edges of each segment are prominent and rounded. The abdominal segments are well defined. On the thoracic segments appear three pairs of broad leg pads. A few sparse, delicate hairs are seen under the microscope.

The appearance of pupal characters in the larva was observed in one individual during this study. This larva molted twice normally, but, instead of pupating with the third molt, it retained the larval form and in addition assumed pupal characteristics, including legs, wing pads, and short but very noticeable antennae. It continued to feed and tunnel into the potato after this abnormal change. Wigglesworth (*14*) states that this phenomenon is probably due to the action of two competing hormones, one inducing growth and the other inhibiting metamorphosis. No previous record of the appearance of this condition in the family *Curculionidae* is available.

The maturing larva, or prepupa, is characterized by the gradual shortening of the body, gradual thickening of the thoracic region, and the appearance of swellings where the wings and legs of the adult are to appear.

Pupa

The pupa (Cover illustration) is at first pure white. Later the eyes, wing pads, and legs turn dark brown or almost black, while the remainder of the body becomes yellowish. The head and beak are folded down upon the breast. The wing pads are short and narrow, and are folded over on the ventral side of the body. The abdominal segments are distinct, with the last segment bearing two tubercles that curve backward and outward. The abdomen is mobile. The head is ornamented with several minute tubercles, and each abdominal segment is decorated with a distal row of very small tubercles, all of which bear setae or slender hairs. It is about one-sixth to one-fifth of an inch long.

Adult

The adult (Cover illustration) of the sweet potato weevil is a snout beetle of antlike appearance. It has a narrow head and thorax, long legs, and a distended body. The elytra, or wing covers, are metallic dark blue, the head and snout dark blue, and the thorax and legs brick red. The long antennae are reddish brown, with the distal segment lighter and forming a thick club. In the male this club is slender, with parallel sides, and is longer than the total length of the remaining segments. In the female it is oval and shorter than the total length of the remaining seg-

ments. The snout is stout, slightly curved, and about twice as long as the head, with the antennae attached slightly beyond the middle. The antennae, tibiae, and tarsi are clothed with small bristly hairs. The claws are black. The adult is about one-fourth of an inch long.

REARING TECHNIQUE

Observations on the life history of the sweet potato weevil were conducted under both outside and controlled temperatures, to show the effect of temperature changes on development. The outside-temperature records were obtained with a recording thermograph. The incubators used in controlled-temperature studies were electrically heated, and were controlled by adjustable thermal regulators.

Adult weevils were paired on the date of emergence from sweet potatoes, and each pair was put in a 2-ounce tin salve box and supplied with a small section of sweet potato root. Every day the pieces of sweet potato were removed and examined for eggs, and new sections were placed in the boxes. The number of eggs laid each day by each female was recorded. Some of the eggs were placed in salve boxes and the incubation period was recorded. A dissecting needle was used in opening egg cells to determine the time of hatching.

Sweet potato cubes about 1.5 by 1.5 by 2 cm. were used in studying the larvae. A small plug was removed from one end of the cube, and a cavity was drilled at the bottom of the plug with a spear-headed needle, to receive the newly hatched larva. Then the plug was replaced securely. Each cube was numbered with an indelible pencil, and several of the cubes were placed in a salve box. The cubes were broken open daily, and the larvae were observed and transferred to newly prepared cubes. Pupa-tion and transformation occurred in the sweet potato cubes, and individual records were kept until the adults emerged.

DEVELOPMENT OF THE INSECT

Incubation

Eggs are deposited singly in specially prepared cavities or cells in roots and vines of the host plants. Egg cavities may be distinguished from feeding punctures by the mucilaginous covering secreted by the female. They are usually at 60° angles, whereas feeding punctures are more likely to be perpendicular. The cavities are slightly enlarged at the bottom to accommodate the eggs. The eggs are attached to the covering of the cell.

The incubation period of 2,924 eggs was recorded during these studies. Most of these observations were made on eggs exposed to outside temperatures. The shortest incubation period recorded, 4 days, occurred during July and August, when the average mean temperature was above

80° F. The longest incubation period, 56 days, occurred during the winter, when the average mean temperature was around 51° F.

Larval Development and Habits

The color of the developing egg remains unchanged until immediately before hatching, when the dark head of the larva can be seen at the upper end of the egg. The young larva eats through the shell, usually at the lower end, and by contractions of the body forces itself through the exit hole. The egg shell is left behind in the egg cavity when the young larva tunnels into the host material.

There are usually three larval instars, but an occasional fourth instar was recorded in this study. The first instar lasted approximately 4 days for 104 specimens observed, the second instar of 97 specimens was approximately 4 days, and the third instar of 167 specimens lasted approximately 7 to 8 days, or about as long as both the first and second instars combined.

First-instar larvae usually bore perpendicularly into the sweet potato to the depth of about 0.5 cm., then tunnel longitudinally within the potato. The first molt occurs in the upper layer of the longitudinal tunnels. The larva excavates a slightly enlarged cavity in the burrow, in which it sheds its skin. In this process the old skin begins to split over the head and is gradually pushed backward over the body by a series of contractions, vigorous twistings, and lateral movements. This requires from a few minutes to several hours, depending on the temperature.

Second-instar larvae have no consistent direction of tunneling, but usually burrow deeper into the potato than the first-instar larvae before molting. Third-instar larvae tunnel in various directions and go deeper into the potato than do the others, sometimes reaching the center of a large potato. Therefore, the most damage to sweet potatoes (Fig. 2) is caused by the third-instar larvae. They, as they approach maturity, feed near the surface. Larvae of all three instars sometimes retrace their burrows for short distances.

The larval stage of 236 individuals was observed under outside temperatures. The shortest period, 12 days, was recorded during July and August. The longest period, 154 days, extended from October to early in March.

Pupation

The full-grown larva excavates a cell two or three times the size of its body in which to pupate. This cavity is usually located near the surface. After preparing the cell the larva ceases feeding and becomes quiet for one or more days before pupating.

The first external indication of pupation is the splitting of the head

capsule of the prepupa between the rudimentary antennae and the skin on the dorsal thoracic region. Through these openings the head and thorax of the pupa appear. The old larval skin is then gradually pushed over the posterior end of the body by a series of body contractions and vigorous movements.

The pupa usually remains quiet, but if disturbed it moves by circular twistings of the abdomen, and may sometimes turn over.

The time required for the pupation of 201 individuals under observation varied inversely with the temperature. The minimum length of this stage, 5 days, was observed in August and September, and the maximum, 49 days, in December. The average length of this stage under controlled temperature, between 78° and 82° F., was 7.5 days.

Development of the Adult

At the end of the pupal stage the pupal skin is split down the back from near the head. The new adult pulls its head out of the old skin and then its legs. As soon as the legs become rigid they are used to push the skin off the rear of the body. The partially exposed wings are wrinkled at first but after a short time body fluids flow into them, expanding them to full length beyond the wing covers, in which position they remain until hardened. The wings are then folded in the normal manner under the wing covers. The newly transformed adult is almost white and rather helpless. A minimum of 4 days is required for it to become able to cut a passageway to the surface of the potato and emerge. This emergence period averaged 7 days in July at a mean temperature of 82° F., and 37 days in December at 52° F.

The period from emergence from the pupal cell to oviposition was observed for 155 females from July 19, 1937, to August 6, 1939, under outside temperatures. It required from 1 to 119 days, or an average of 15 days. In a controlled-temperature cabinet at a temperature of 78 to 82° F., however, oviposition of 25 other females took place in from 3 to 14 days, or in an average of 4.5 days.

Laboratory studies on the adult life of 103 pairs of weevils were completed in December 1939. Complete data were obtained on 90 males and 100 females. The length of life of the males after emergence ranged from 3 to 187 days, averaging 72, whereas that of the female ranged from 3 to 254 days, averaging 85. In other studies several specimens of both sexes lived well over 300 days and one male lived 416 days.

MATING AND OVIPOSITION

Normal egg-laying does not take place until after mating. Under experimental conditions, however, 14 isolated females caged at 80° F. for 30 days, laid 7 unfertile eggs as compared with 926 fertile eggs laid by

comparable females caged with males. At the end of this period 9 of the unmated females were caged with males. They began to lay fertile eggs normally the following day. The mating process of one pair was observed to last over 45 minutes. Mating seems to occur at any time and at frequent intervals. A single mating, however, appears to be sufficient for lifetime. Mated females isolated in September laid fertile eggs the following March without having an opportunity for further mating.

Oviposition was observed from June 1938 to August 1939. Some eggs were laid in every month of the year, but the rate of oviposition declined slightly during September and October, dropped sharply in November, and then became negligible until March. It picked up slowly until the latter part of April, when it began to increase tremendously. The oviposition period of 84 females ranged from 1 to 249 days, with an average of 62 days. These females laid from 1 to 319 eggs, an average of 119 each. Twenty-five females confined in a controlled-temperature cabinet operating between 78° and 82° F. laid from 0 to 202 eggs, with an average of 78 per female.

During December 1938, 50 pairs of adults were observed daily. On two days with daily mean temperatures of 62.5° and 65° F. the adults were active, fed a great deal, and laid eggs. During the remainder of the month the daily mean temperatures ranged from 34° to 61° and no eggs were laid. At temperatures from 45° to 61° the adults were sluggish and fed very little. At 42° they were very sluggish and did not feed whereas at temperatures below 42 there was no activity.

The post-oviposition period of 117 females under observation between July 1937 and August 1939 averaged 14 days, ranging from 1 to 103 days. In a controlled-temperature cabinet operating between 78° and 82° F. the post-oviposition period of 25 females ranged from 1 to 40 days, averaging 5 days.

FEEDING HABITS OF ADULTS

The adult weevil will feed on any exposed part of the plant, but prefers the potatoes, into which it makes tiny holes (Fig. 1) with its long slender snout. These feeding punctures occur in patches and are very shallow. In the field the weevil does more feeding on the stem end of the potato, because it is nearer the surface of the soil and therefore more accessible. For the same reason the upper surface of the larger potatoes beneath or near cracks in the soil are more likely to be fed on. The weevil avoids light, and therefore feeds on the under surface of potatoes exposed to light in storage.

The adult sweet potato weevil on the vines feeds by gnawing rather than by making distinct punctures, as it does on the roots. On the main stems, petioles, and leaf veins the feeding scars often run together or

overlap. The weevil feeds on the crown or basal part of the vines, stems, petioles, and leaf veins, in approximately the order given. In May and June 1939 volunteer sweet potato plants were collected from the fields and examined for the distribution of feeding. In May the feeding was as follows: 70.2 per cent on the stem, 29.3 per cent on the leaf petioles, 0.3 per cent on the young leaves, and 0.2 per cent on the leaf veins. In June 58.1 per cent of the feeding was on the stems, 37.7 per cent on the petioles, 3.3 per cent on the young leaves, and 0.9 per cent on the leaf veins.

In a laboratory test two male and two female weevils were placed between a healthy young sweet potato vine and a potato in each of five cages and were observed at intervals for 22 days. In 75 per cent of the observations the weevils were on the potatoes and in only 11 per cent were they on the vines.

During a 2-week period an experiment was conducted in the laboratory to determine the effect of different qualities of light on the feeding of adults. A box was lined with heavy black cloth and was covered with transparent, red, and blue cellophane and thick, black photographic paper, in such a manner that each material covered one-fourth of the box. Pieces of sweet potato were cut so that weevils could feed and deposit eggs only on the surfaces exposed to light. One piece was placed in each corner of the box, and a number of weevils were released in the center of it. Light was supplied by a 100-watt light 5 feet above the box. The temperature of the room was approximately 80° F. The pieces of potato were examined daily for feeding punctures and for the number of eggs deposited. At the end of the experiment there were 1,997 feeding punctures and 117 eggs under the blue cellophane, 4,059 feeding punctures and 312 eggs under the transparent cellophane, 8,525 feeding punctures and 795 eggs under the red cellophane, and 12,830 feeding punctures and 1,529 eggs under the black paper. This experiment indicated that most of the feeding and oviposition took place in the absence of light. The second greatest amount was in the light passing through the red cellophane, an indication that the red-light rays appeared almost like darkness to the weevils. The least amount of feeding and oviposition was done in the light passing through the blue cellophane.

In one test the rays of a selective spectrum were focused on adults on a shallow, white-enameled tray. Five sweet potato vines for food were placed in the tray, at equal distances apart, so as to barely extend from one side of the spectrum to the other. Adults showed a marked preference for the violet end of the spectrum, followed by the blue, red, orange, yellow, and green, in the order given.

SURVIVAL OF ADULTS

Adults were caged without food during 1937 and 1938 in sweet po-

tato fields and in adjacent uncultivated areas, or headlands, to determine the length of time they could live without food. These cages were approximately 2 feet high and 3 feet square, and most cages contained 100 adults each. The cages were examined at intervals for live weevils. Adults lived longest in cages placed over headland grasses and weeds. During the winter of 1937-38 the longest period an adult was observed to live without food was 119 days, but during the winter of 1938-39 it was 144 days. One adult lived 50 days in the spring of 1939, another lived 28 days in the summer of 1939, and 2 adults lived 44 days in the fall of 1938. In cages set on headlands during the winter, the survival after the indicated number of days without food was as follows:

<i>Days</i>	<i>Per cent survival</i>	<i>Days</i>	<i>Per cent survival</i>
119	1.0	113	1.4
135	.2	122	.8
125	.6	126	.2
130	.4	134	1.0
144	.2		

During the winters of 1937-38 and 1938-39 screen cages 4 inches in diameter and 7 inches high were placed in the field and filled with trash and dead grass. One hundred adults were put in each cage without food. The survival after 30, 60, and 90 days in 1937-38 was 64 per cent, 12 per cent, and none, respectively; in 1938-39 it was 48 per cent, 7 per cent, and 1 per cent, respectively.

Without food the adults lived longer during the winter months than in the spring, summer, and fall. The higher the temperature the shorter the period of survival. Grass and weeds on headlands apparently furnish some protection to weevils, since they lived longer in cages in these locations than in cages placed in clean fields. In cages in the insectary and in constant-temperature cabinets operated between 78° and 82° F. survival was much shorter than in unprotected field cages.

Winter survival of adults is very important, because a few adults can live in the fields from late harvest until plants have sprouted on seedbeds the following spring. These few survivors are sufficient to perpetuate infestations on sweet potato farms.

Records on the winter survival of adults in field cages with sweet potatoes for food were also obtained. During the winter of 1937-38, the percentage of survival in four cages was 16, 28, 19, and 2 per cent; 4 per cent of the adults survived the winter of 1938-39 in one cage. Of 25,000 to 30,000 adults in insectary cages with sweet potatoes in the fall of 1938, less than 1,000 were alive the following April.

During the winter of 1939-40 a very unusual freeze occurred in St. Landry Parish, when the temperature dropped to 11° F. on January 19

and to 13° on January 27, followed by freezing temperatures for 17 consecutive days. A 3-inch sleet on January 18 and 19 was followed by 3 inches of snow on January 22. No sweet potato weevil adults in the winter-longevity cages survived this cold weather. In one cage, however, one male and seven females, or 8 per cent of the adults, were alive on January 22, after 4 days of freezing weather, with the temperature dropping to 11° on one day. These adults were brought into the laboratory, where they lived and the females deposited eggs that hatched.

The activity of adults depended upon the temperature and did not completely cease during any month of the year. When the temperature dropped below 70° F. activity was sluggish, and when it was below 60° oviposition ceased. Very little feeding occurred below 50°, none at 47°, and adults became completely inactive at 43°. In the laboratory all adults subjected to 30° for 7 days were killed. In the field adults apparently can survive longer at an average temperature of 30° because of fluctuations.

FLIGHT

Prior to these investigations the sweet potato weevil had only occasionally been observed in flight and then only for short distances. The source of new infestations was therefore considered to be almost entirely from the transportation of infested plants or sweet potatoes. These investigations, however, show that adults fly freely during the warm part of the year, but seldom at temperatures below 65° F. One night 169 specimens were caught in an electric light trap placed about 40 feet from infested sweet potatoes. This trap, equipped with a 40-watt bulb and located on the back porch of the laboratory, was operated two nights each week from April 13 through November 1937. Of the weevils caught, 84 per cent were males. The numbers caught each month were as follows:

<i>Month</i>	<i>Weevils caught</i>	<i>Month</i>	<i>Weevils caught</i>
April	6	August	169
May	14	September	110
June	75	October	36
July	125	November	0

A study of the dispersion of the weevil was made during 1938 and 1939 on rice farms in the vicinity of Abbeville and Crowley, La., where very few sweet potatoes are grown. Here, areas several square miles in size were located that were not infested with the sweet potato weevil. Storage banks containing 3 to 10 bushels of infested sweet potatoes were set up as sources of infestation. At distances of approximately $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 mile from each of these infested storage banks from 300 to 800 uninfested sweet potato plants were set out and cultivated during each

crop season. By October of each year most of the plantings were infested, a fact which indicated that the weevil could spread by flight at least 1 mile in a season. As shown in the following tabulation, the percentage of plants infested did not seem to be influenced much by the distance from the infested storage banks.

<i>Yards from source</i>	<i>Per Cent of Plants Infested</i>	
	<i>At Crowley, La.</i>	<i>At Abbeville, La.</i>
440	17.3	12.7
880	44.8	11.7
940	44.9	.
1320	11.4	7.7
	...	15.8
1440		0
1660	30.0	...
1760	25.7	3.8

Since the weevils evidently spread from the infested storage banks to the uninfested trap plantings by flight, an experiment was begun in 1939 with light traps to determine the distance of flight from one of these storage banks. Electric, gas, and kerosene lights were employed. An aniline dye, Oil Red O, was dusted into the storage bank at intervals. Each week from 5,000 to 10,000 adults were dusted with the dye and liberated in the storage bank, to provide a large and constant flight. A male and a female weevil with dye on their bodies were caught in a light trap $1\frac{1}{4}$ miles from the storage bank, and 25 males and 3 females were caught 1 mile away. All these weevils had to traverse a rice field $\frac{1}{4}$ to $\frac{3}{4}$ of a mile wide and flooded with 4 to 8 inches of irrigation water.

During 1939 tanglefoot screens were used on different farms in St. Landry Parish. In each location two vertical screens were placed at right angles to each other so that a surface was exposed to any breeze or line of flight. Some of the screens were on the edges of old sweet potato fields, and some in field roadways. Between July 27 and August 27, 13 adults were collected at three different locations. These studies indicated that while some of the weevils were moving from the old infested fields to the newly planted fields, others were flying indiscriminately.

In 1940 two sets of tanglefoot screens were used to determine the effect of wind currents on flight and the elevation at which adults fly. Each set consisted of three screens, 3 feet wide and 4 feet high mounted perpendicular to the ground (one above the other) and spaced to extend from the soil surface to 4 feet, from 9 to 13 feet, and from 18 to 22 feet high. One set of screens was in line with the prevailing wind currents and the other across them. Each set was 22 feet from a bank of infested

sweet potatoes. The screens were examined twice each week. The bottom screens collected more adults than did the others. However, the top screen that had the advantage of the prevailing breeze collected six specimens. More weevils were caught in line with the prevailing breeze than against it. The fact that adults were collected at an elevation of approximately 20 feet within 22 feet of the storage bank indicates that they were gaining elevation very rapidly and that they fly considerable distances.

In 1941, eight single tanglefoot screens were placed on three sides of a sweet potato field at the Experiment Station. Twice each week 1,000 artificially colored adults were released in this field. Between July 17 and August 25, 44 adults were collected. The screens were not operated between August 25 and September 9, and no liberations were made after August 25. From September 9 to September 30, 40 of the colored adults were collected on the screens.



FIG. 4. Luxuriant growth and blossoms of the morning glory (*Ipomoea trichocarpa*), a host of the sweet potato weevil.

These observations showed that some flight may take place at any time during the day or night, but little during the day, unless the insects are disturbed. During a 10-day period one electric - light trap caught 150 adults on five alternate nights, when it was turned off at 8:30 p.m., and 436 on the other five nights, when it was operated throughout the night. Females taken at the trap were placed in cages with sweet potatoes, where they oviposited and the eggs hatched normally.

Flight was more general on dark nights than on bright

moonlit nights. Adults also flew most freely during calm weather or when there were gentle breezes. A wind-direction indicator, operated in conjunction with the light traps, showed that more adults were collected in line with the breeze than against it. One light trap 220 yards from the dispersal point collected 40 adults on eight nights, six of which were favorable for flight toward the trap. On two nights with breezes away from the trap only 4 adults were caught. Another light trap 880 yards from the dispersal point caught 26 adults on seven nights, on five of which the breezes were favorable for flight. On the nights with unfavorable

breezes only 2 adults were caught.

HOST PLANTS

Laboratory Tests

In laboratory studies extending over several years more than 100 of the native plants growing in St. Landry Parish were tested as host plants of the sweet potato weevil. The plants were transplanted from fields to large flowerpots, over which were placed glass globes covered with cheesecloth. The pots were embedded in moist soil in an insectary and thrived unusually well. Ten male and 10 female weevils were placed in each cage and were observed at regular intervals until all were dead. Large field cages were also used in breeding and host-preference studies.



FIG. 5. The cypress vine, *Ipomoea quamoclit*, a wild host of the sweet potato weevil, growing as an ornamental.

Weevils bred in the following *Ipomoea* plants: *batatas*; *pes-caprae* (L.) Sweet (Fig. 6); *bona-nox* L. x *hederacea* Jacq.; *dissecta* (Jacq.) Pursh; *hederacea* Jacq.; *hederacea* var. *integriuscula* Gray; *heptaphylla* (Rottb. and Willd.) Voight; *machrorhiza* Michx.; *lacunosa* L.; *Littoralis* (L.) Boiss.; *muricata* Jacq.; *pandurata* (L.) G. F. W. Mey; *quamoclit* L. (Fig. 5); *sagittata* Cav.; *setosa* Ker.; *trichocarpa* Ell. (Fig. 4); and *Ipomoea* sp.



Figure 6.—The wild host *Ipomoea pes-caprae* of the sweet potato weevil on a sandy seashore.

Adults also feed to some extent on the plants shown in Table 1.

TABLE 1.—Plants on which adult sweet potato weevils fed but did not breed

Plant	Amount of feeding	Part of plant fed on
<i>Amaranthus</i> sp.	Slight	Under side of leaves; petioles
<i>Amaranthus spinosus</i> L.	do.	Under side of leaves
<i>Cuscuta</i> sp.	Considerable	Stems
<i>Dichondra carolinensis</i> Michx.	Heavy	Stems; petioles
<i>Jacquemontia tamnifolia</i> (L.) Griseb.	do.	Main stem; petioles
<i>Physalis orinoccensis</i>	Slight	Petioles; under side of leaves
<i>Phytolacca americana</i>	do.	Do.
<i>Sesbania exaltata</i>	do.	Stem, near soil surface
<i>Sida</i> sp. (probably <i>rhombifolia</i>)	do.	Leaf veins
<i>Solanum carolinense</i> L.	do.	Under side of leaves
<i>Solanum nigrum</i> L.	do.	Do.
<i>Solanum tuberosa</i> L. (plant)	Moderate	Main stem; petioles
(tuber)	do.	Around stem scar
<i>Vigna sinensis</i> (L.) Endl. (cowpea)	do.	Under side of leaves; stem, near soil surface

Field Experiments

Wild hosts were planted in the field during 1940-41 to test weevil preference between the common native hosts. In 1940 five wild hosts and in 1941 seven wild hosts were grown in replicated field plots with sweet potatoes. Each plot consisted of four plants spaced 4 feet apart in single rows, and was replicated six times in 1940 and eight times in 1941. Each year all the plants were examined in October to determine the degree of infestation. The average numbers of weevils found per plant were as follows:

Species of <i>Ipomoea</i>	Average number of weevils per plant	
	1940	1941
<i>batatas</i> (sweet potato)	35	16
<i>hederacea</i> var. <i>integruscula</i>	12	18
<i>hederacea</i>	9	14
<i>quamoclit</i>	8	24
<i>trichocarpa</i>	6	8
<i>pandurata</i> (L.)	2	1
<i>lacunosa</i>	..	7
<i>heptaphylla</i>	..	31

In 1940 an average of 57 additional weevils per plant and in 1941 an average of 43 additional weevils per plant were taken from the potatoes of these plants.

Survey of Host Plants

During July and August 1941 a survey of hosts was conducted on 14 farms in the vicinity of Sunset, St. Landry Parish, to determine (1) the distribution and occurrence of the weevil, (2) its relative abundance, and (3) the intensity of infestation. The farms selected for the survey represented different local soil types and were in an area approximately 12 miles long and 4 miles wide. Sweet potatoes are grown on all the farms every year. Some farms were classed as heavily infested, but the status of others was unknown. The results of this survey are shown in Table 2.

During September 1941, 55 properties, including residences, business places, and vacant lots in the village of Sunset, La., were surveyed for wild host plants of the sweet potato weevil and for their infestation by this insect. Thirty-nine properties contained *Ipomoea* plants, and infested plants were found on 8 of them. Of the 4 species infested, *trichocarpa* was the most common, being found on 5 properties. The other species were *quamoclit*, *hederacea* var. *integriuscula*, and *muricata*.

During 1939 examinations were made of volunteer sweet potato plants and several varieties of wild host plants on a heavily infested sweet potato farm from which infested sweet potatoes were not removed the preceding year. Samples of about 100 plants of each variety present showed 54 per cent of the volunteer sweet potato, 72 per cent of *hederacea integriuscula*, 35 per cent of *hederacea*, and 28 per cent of the *pandurata* plants to be infested.

Away from St. Landry Parish infestations were also found in the following species of *Ipomoea*: *trichocarpa*, *quamoclit*, and an unidentified species in Alexandria, La.; *sagittata*, *littoralis*, *pes-caprae*, and *trichocarpa* in southern Alabama; *littoralis*, *pandurata*, *trichocarpa*, *sagittata*, and *dissecta* in southern Mississippi; and *littoralis*, *pes-caprae*, and *trichocarpa* in southern Georgia.

The examination of many wild hosts during several years showed that a few weevils passed the winter in them. Specimens were found to have overwintered in *Ipomoea sagittata* near Slidell, La.; in *pandurata* in Baldwin County, Ala.; in *littoralis* and *dissecta* on the Gulf coast of Mississippi; and in *trichocarpa* in Thomas County, Ga. Large numbers of roots of *pandurata* were examined early in the spring for several years. Many of them contained weevil tunnels and some of them dead weevils, but very few live weevils were ever found.

The data collected indicate that only a small percentage of weevils

TABLE 2.—Plants of *Ipomoea* species found on 14 farms in St. Landry Parish, La., and number infested with the sweet potato weevil, 1941

Farm	<i>pandurata</i>		<i>hederacea</i> var. <i>integriscutella</i>		<i>quamoclit</i>		<i>trichocarpa</i>		<i>hederacea</i>		<i>batatas</i> ¹		All species	
	Total	Number infested	Total	Number infested	Total	Number infested	Total	Number infested	Total	Number infested	Total	Number infested	Total	Number infested
Dimmick	168	1	319	0	200	0	87	0	7	0	50	1	781	1
Beaugh	117	67	74	0	93	0	1	0	218	7	0	0	503	74
Thomas	0	0	80	4	0	0	195	6	24	3	0	0	299	13
Kemp	0	0	93	0	0	0	292	0	69	0	123	0	454	0
Barry	143	12	99	1	0	0	110	1	44	1	0	0	396	14
Ogc	114	10	153	2	0	0	30	0	75	1	0	0	372	13
O. Dimmick	0	0	129	0	0	0	98	0	34	0	0	0	261	0
Aaron	0	0	24	0	0	0	115	0	8	0	0	0	147	0
Horaist	0	0	82	0	0	0	83	0	56	0	61	0	221	0
Savoy	0	0	80	0	0	0	30	0	25	0	0	0	135	0
Landry	42	0	62	0	0	0	113	0	46	0	0	0	263	0
Williams	21	1	33	0	0	0	65	2	8	0	0	0	127	3
Guilbeau	0	0	24	0	0	0	105	0	6	0	0	0	135	0
Boudreaux	0	0	247	0	310	0	365	0	33	0	0	0	955	0
Grand Total	605	91	1,499	7	603	0	1,689	8	653	12	234	1	5,049	118

¹Volunteer plants, not included in the totals.

overwintered in wild host plants. The importance of these plants in the overwintering of weevils is apparently not so great as has been thought.

NATURAL ENEMIES

Parasites

Early in August 1940 at Baton Rouge a number of dead third-instar larvae of the sweet potato weevil were found in their tunnels in sweet potato vines. Each presented a characteristic, blackened appearance, and had a small cocoon of a hymenopterous parasite attached to it. During the month 24 of these parasites were discovered and 5 of them emerged. In September more parasites were found. Adult parasites reared from these weevil larvae were identified⁶ as *Microbracon mellitor* (Say) and *punctatus* Mues. Another hymenopterous parasite was found in tunnels, where it was actively feeding on weevil larvae. It attacked them from the exterior and made no cocoon.

During September 1940 the following parasites were recovered at Sunset, La.: *Metapelma spectabilis* Westw., reared from a group of sweet potato weevil larvae or pupae taken from tunnels in a vine of *Ipomoea quamoclit*. Five cocoons taken from weevil tunnels in sweet potato vines, one of which was attached to a dead larva, were identified as *Microbracon* sp., probably *punctatus*.

During the fall of 1941 at Sunset a number of parasites were found in sweet potato weevil tunnels in wild host plants. Some of them were actually feeding on the weevil larvae. From *Ipomoea heptaphylla* 7 larvae and 12 cocoons were recovered, from *quamoclit* 1 larva and 3 cocoons, and from *hederacea* 1 dead adult were recovered. All the specimens were transferred to petri dishes and placed in a controlled-temperature cabinet. All the adults reared from this material were identified as *Microbracon punctatus*, and the cocoons were identified as *Microbracon* sp. Since no other host species was recovered, some of these were actual weevil parasites.

Nematodes

Nematodes have been collected on sweet potato weevils at Biloxi, Miss., by the senior author and at Sea Island, Ga., and Fernandina, Fla., by Troy Thompson. Those from Biloxi were identified⁷ as *Rhabditis* sp. and *Apehelenchus avenae*. One lot of specimens was infested with a species of *Neoplectana*, but specific identification was not made. The larvae of this form were extremely numerous on the host. The specimens from Fernandina contained a new species of *Acrobeloides* and numerous

⁶All parasites were identified by the Bureau of Entomology and Plant Quarantine.

⁷All nematodes were determined by the Bureau of Plant Industry, Soils, and Agricultural Engineering.

larvae of what appeared to be a species of *Neoapectana*. The weevils were breeding in the wild host *Ipomoea pes-caprae*.

Mites

Numerous mites have been observed from time to time infesting weevil adults, sometimes heavily. Two mites were identified,⁸ one as a species of Parasitidae of doubtful genus and the other as a species of Tyroglyphidae. These mites were classed as "riders" and were apparently harmless. During biology studies at Baton Rouge an unidentified species of mite was collected on eggs and in sealed egg cavities, but no feeding on the eggs was observed.

Predators

Argentine ants—Argentine ants destroy numbers of exposed sweet potato weevils, particularly the immature stages and eggs that are accessible. There is some evidence that ants have removed eggs or the immature stages from cavities or tunnels when they are very near the surface. Larvae and pupae placed in petri dishes in fields where this ant occurred were readily seized and carried away. Sweet potatoes containing 86 weevil eggs, deposited over a period of 3 days, were placed on the grass in the shade of sweet potato vines in a plot heavily infested with this ant. After a 2-day exposure the sweet potatoes were placed in a controlled-temperature room at 80° F. When they were examined 12 days later no eggs or larvae were found.

Mice—Mice have been known to destroy weevils in stored sweet potatoes. Most of the pupal cells are near the surface of the tuber, and mice frequently gnaw away the surface and devour the pupae or the newly transformed adults. Several weevils have been thus removed from a single sweet potato.

Birds—Birds are of little importance as predators, because of this insect's habit of avoiding light and remaining hidden on the under side of leaves, potatoes, and field trash. Poultry have been observed scratching in piles of small cull potatoes and refuse around old storage and seedbed sites and eating the adult weevils thus exposed.

Diseases

A fungus identified as a species of *Fusarium* was discovered in two collections of weevils—one from Picayune, Miss., by W. B. Hollingsworth in 1932 and the other from Biloxi, Miss., by the senior author in 1935. E. H. Frederic and M. H. Tankersley collected greenish appearing specimens in 1939 at Saint Simon Island and Sea Island, Ga., where 75 per cent of the weevils infesting the wild host *Ipomoea littoralis* were dying. Troy Thompson also collected dead immature specimens in Glynn County, Ga., that had the green coloration.

⁸Identification by the Bureau of Entomology and Plant Quarantine.

During 1940 at Baton Rouge dead larvae, pupae, and adults were found to be infected by a fungus disease that produced green spores. Some of these spores were placed on larvae and pupae in test tubes. The insects turned pink at the place of infection, and then red after death. This disease was not identified.

The fungus *Beauveria globulifera* (Speg.) Pic. was also present in the collections of material from Biloxi in 1935 and appeared to be equally as parasitic as the *Fusarium*. Of the caged specimens, 50 per cent were killed by the two fungi. *Beauveria globulifera* is a widely distributed fungus, which develops in the presence of high humidity. It has killed large numbers of caged sweet potato weevils at Baton Rouge, Sunset, and Opelousas, La., and has also been observed many times over a period of years in the field, particularly on weevils in stored sweet potatoes. Some efforts were made to culture and breed this fungus as a control measure. Many caged adult weevils were killed by spraying them with a spore suspension from such a culture. However, under dry conditions the fungus became ineffective.

SEASONAL OCCURRENCE

A large number of sweet potato weevil adults were released on June 13, 1940, in a sweet potato field set with uninfested plants on June 10. At weekly intervals until the end of August, 100 random plants were dug and examined for weevil infestations.

Eggs were found in 33 per cent of the plants on June 21, at which time a first-instar larva was found as shown in Table 3. Second instars were present at the end of 2 weeks and third instars, pupae, and adults at the end of 3, 4, and 5 weeks, respectively. Weevils were found to be completing their life cycles in the vines in August in a little over a month, which compared closely with the period required for development within the potatoes. The infestation per 100 hills increased steadily from 55 specimens on June 21 to 5,675 on October 31. In the fall there was a decided shifting of infestation from the aboveground parts of the plant to the underground parts. August 21, 13 per cent were underground, whereas 87 per cent were underground on September 18, 94 per cent on October 31, and 100 per cent on November 15. Although the liberation of adults in this field soon after the plants were set caused an early and severe infestation, such a condition could occur naturally in fields near heavily infested storages.

EFFECT ON YIELD OF SWEET POTATOES

Neither feeding by weevils nor their development in the plants appears to affect plant growth except when in excessive amount on small plants. Uninfested plants in field plots made faster growth during the

TABLE 3.—Seasonal infestation of a sweet potato field in which adult weevils were released June 13, 1940

Date of examination	Sweet potato weevils found in 100 plants					Per cent of weevils found in				
	Eggs	First instars	Second instars	Third instars	Pupae	Adults	Total	Petioles	Stems	Roots and crowns
June	21.....	54	1	0	0	0	55	60	38	2
	29.....	97	18	11	0	0	126	51	48	1
July	9.....	37	46	33	22	0	138	41	37	22
	16.....	17	100	66	49	9	241	55	17	28
Aug.	23.....	7	140	174	125	18	469	42	47	11
	1.....	19	114	142	152	36	486	2	87	11
	8.....	5	40	92	178	40	425	5	80	15
	14.....	3	24	58	156	72	439	2	82	16
	21.....	25	44	128	183	43	645	5	82	13
	18.....	358	491	723	1,609	1,167	4,750	1	13	86
Sept.	31.....	272	678	686	1,717	1,337	5,675	5	1	94
Oct.	15.....	396	585	337	662	598	3,398	0	0	100
Nov.	25.....	385	179	148	559	431	2,285	0	0	100

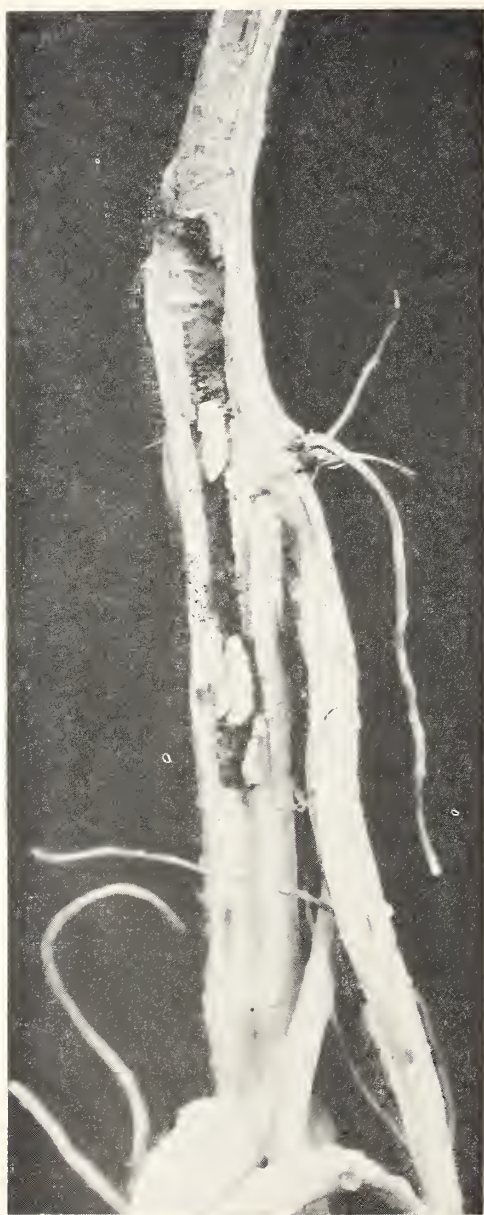


FIG. 3. Sweet potato crown split open to show tunneling, larva, and pupa of the sweet potato weevil.

first month after planting than did infested plants, but thereafter no appreciable difference could be observed.

To determine whether crown infestation had any effect on yield, studies were made of plants with infested and uninfested crowns. The plants were taken in pairs at random, 100 pairs in a location or field plot being considered as a sample. This technique should have equalized the influence of soil fertility and drainage. Only infestation in the crown or base of the plants (Fig. 3) was considered, since it was impractical to determine infestation in the vines beyond this area because of the overlapping and intermingling of vines from other hills and rows.

The sweet potatoes were harvested and examined for weevil infestation. In each of eight samples the total yield was greater for the plants with infested crowns than for those with uninfested crowns. In most samples, as shown in Table 4, the potatoes from plants with infested crowns were more heavily infested, but the yield of marketable uninfested potatoes was also greater.

Evidence of the weevil's preference for the more vigorous plants was obtained by comparing the infestation and yield of 100 vigorous and 100 weak plants. Except for vigor, the plants were comparable as they were staked at random in a field of plants from the same source.

TABLE 4.—Relation of infestation by the sweet potato weevil in the crown of the plants to yield of infested and noninfested potatoes

Sample No. ¹	Per cent of infested potatoes produced from plants with ²		Pounds of marketable potatoes from plants with	
	Infested crowns	Uninfested crowns	Infested crowns	Uninfested crowns
1	23	12	38	31
2	27	33	89	80
3	20	18	54	57
4	12	6	16	13
5	24	17	78	61
6	23	18	114	99
7	43	39	69	58
8	58	45	83	71
All samples	30	26	540	468

¹Each sample consisted of 200 plants, 100 of which had infested crowns.

²Per cent by weight.

They were staked in June and harvested in October. The vigorous plants were 23 per cent more heavily infested than were the weak plants, and produced 37 per cent more infested potatoes and 36 per cent more marketable potatoes. It is thought that the sweet potato weevil is attracted to the more vigorous plants, because the larger potatoes which they produce have larger cracks and are more easily reached than are the smaller potatoes on weak plants. The data obtained in these two experiments indicate that crown infestation does not reduce yield, and that weevil adults show a preference for the more vigorous plants.

SANITATION AND FARM PRACTICES

Throughout the course of these studies experiments were conducted on the use of insecticides for the control of the sweet potato weevil in the field. No practical method was found. The grower is therefore dependent on farm sanitation and cultural practices. They may be supplemented by paradichlorobenzene fumigation of sweet potatoes intended for seed or by treatment with DDT. DDT dusts and sprays are very toxic to weevils in storages and around old seedbeds. Since DDT is poisonous to warm-blooded animals, however, it should not be employed on sweet potatoes that are to be used for food or fed to livestock, unless they are thoroughly washed before they are used.

Sweet potatoes can be grown practically free from weevil injury with little extra cost if the following practices are adopted:

1. Be sure the plants or draws⁹ are free from weevils. The safest procedure is to use state-certified plants. If such plants are not obtainable, carefully hand cull the seed potatoes before bedding them. Destroy all seed potatoes that show punctures or other signs of injury brought about by the sweet potato weevil; either burn such potatoes or feed them to livestock. As an added precaution, dust the seed potatoes with 10 per cent DDT when they are stored in the fall, or fumigate the seed potatoes with 1 ounce of paradichlorobenzene per bushel 3 weeks before bedding, and do not open or remove the potatoes from the container or bank until the end of the 3-week period.

2. Clean up the old storage bank or house as soon as it is empty. Burn all straw, trash, and infested and half-rotted potatoes; and apply a dust containing 5 or 10 per cent of DDT to the floor, walls, and empty crates in the storage house at least 1 month before the new crop is planted.

3. Practice crop rotation. Plant the new crop as far away as possible from the sweet potato field of the preceding year.

4. Plant draws for only a small part of the crop. The larger part should be grown from vine cuttings, and the crop produced from draws should be used first. For transplanting, cut the vines several inches above the surface of the soil. As soon as transplanting has been finished, destroy the old seedbeds and thoroughly dust or spray the area with DDT.

5. When the crop is laid by, throw the soil up high around the base of the vines. The potatoes will thus be covered deeply with soil, and it will be difficult for the weevils to reach them and lay their eggs in them.

6. In the old sweet potato field plant a crop that requires clean cultivation, since frequent cultivation will destroy any volunteer sweet potato plants.

7. Harvest the crop. Cut the vines off at the surface of the ground and remove them before plowing out the potatoes. Burn the vines as soon as they are dry. Hand-cull the potatoes in the field while they are being plowed out. Burn all weevil-infested potatoes or feed them to livestock. Pick up from the field and destroy all crowns, roots, small potatoes, and scraps that have been left after the harvest. Turn the hogs and cattle into the field immediately after harvest to destroy small potatoes and roots that the diggers missed. Replow the field at least twice during the winter.

8. Do not bank or store potatoes in the same place two years in

⁹The term "draws" is commonly applied to sprouts that develop directly from the sweet potato in the plant bed.

succession, unless a permanent house is used that can be cleaned thoroughly.

9. Dig out or otherwise destroy all volunteer sweet potato plants, wild and ornamental morning glories, and cypress vines in and around fields, plant beds, and storage sites, to prevent weevils from breeding in those plants.

SUMMARY

The sweet potato weevil (*Cylas formicarius elegantulus* (Sum.)) is the most destructive insect enemy of sweet potatoes in the United States. It is mostly confined to the coastal sections of Florida, Georgia, Alabama, Mississippi, Louisiana, and Texas. Studies on its biology and habits were made from 1937 to 1949 in Louisiana to obtain information on the factors affecting its survival and on how to prevent its spread.

In Louisiana the incubation period ranged from 4 days in the summer to 56 days in the winter. The average number of eggs laid per female was 119. The larval period ranged from 12 to 154 days, the pupal period from 5 to 49 days, depending upon the temperature, and the average duration of the adult period was 72 days for males and 85 days for females.

The adults mate soon after they emerge and the females begin ovipositing almost immediately. The eggs are laid singly in specially prepared cells in the roots and vines of the plants.

Reproduction and activity continue throughout the year in Louisiana, although both are greatly reduced during the winter. The weevil may have from six to eight generations a year, and all stages may be found at any time. Although most of the specimens pass the winter in the immature stages, a few adults overwinter in and around sweet potato fields even when food is absent.

The sweet potato weevil attacks not only the sweet potato plant, but also a large number of wild host plants.

The sweet potato weevil was observed to breed and reproduce only in hosts of the genus *Ipomoea*, to which the sweet potato belongs, although it fed on other plants.

The sweet potato weevil is spread largely by the transportation of infested host material from farm to farm or from one locality to another. However, adults were found to be free fliers and were taken in trap lights $1\frac{1}{4}$ miles from the point of liberation.

Natural enemies are of little importance in checking weevil infestation, although a number of enemies have been recorded. The fungus *Beauveria globulifera* kills many adults at times, but it is not considered of much economic importance, because it will not develop under dry conditions.

The most effective control measures have been the use of weevil-free planting stock, rotation of crops, the destruction of volunteer sweet potato plants, the thorough cleaning up of storage sites and old fields, and the destruction of infested sweet potatoes and infested wild hosts.

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PHYSICAL AND CHEMICAL CHARACTERISTICS
OF THE PEATS, MUCKS AND CLAYS OF THE COASTAL
MARSH AREA OF ST. MARY PARISH, LOUISIANA

BY S. A. LYTLE AND B. N. DRISKELL



Couch grass is the typical vegetation of large areas of brackish marsh lands. Trees in the background are the swamps which border the Bayou Cypremort natural levee.

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PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE PEATS, MUCKS AND CLAYS OF THE COASTAL MARSH AREA OF ST. MARY PARISH, LOUISIANA

S. A. LYTLE AND B. N. DRISKELL*

I. INTRODUCTION

The coastal marsh area of Louisiana is a broad, nearly level plain along the southern part of the state, having the Gulf of Mexico as its southern boundary from Sabine River on the west to Pearl River on the east. It extends inland from the Gulf for considerable distances, averaging 20 miles in Cameron and Vermilion parishes, 10 miles in Iberia Parish, 5 to 10 miles in St. Mary Parish, 30 miles in Terrebonne and Lafourche parishes and 50 to 60 miles in the recently active and presently active Mississippi River delta areas of Plaquemines and St. Bernard parishes. The northern limit of the coastal marshes is approximately 30 degrees north latitude, or about the latitude of New Orleans. The coastal marsh area is divided into an older part, west of Vermilion Bay, and a younger part, eastward from the bay (24, 38). In general, the western coastal marsh area is made up of marine sediments and alluvium deposited by the Mississippi and Red rivers when these streams discharged their sedimentary loads along the southwestern coastline of the state (16). These materials are underlain at varying depths by the ancient delta deposits of the Pleistocene Mississippi River. The eastern younger coastal marsh area, located in the present Mississippi River delta, is made up of alluvium deposited as the former and present sub-deltas of the Mississippi River deltaic plain (14), and sediments of marine origin. This coastal area is the site of accumulations of alluvial silts, silty clays and clays deposited by the Mississippi River and the distributary streams of its numerous delta complexes. In general, the coastal marsh area is at or only slightly above mean Gulf level. Larger streams flowing into or through the marsh build up low natural levee ridges of silts and clays along their courses by bank overflow. Where these materials are deposited on the soft peats and mucks of the marsh, they subside by their own weight to near marsh level or to beneath the marsh.

The marsh area is traversed by numerous streams, including both distributary streams and tidal channels. It is an area of many lakes and canals. The most important canal of the coastal marsh area is the

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Intracoastal Waterway, which crosses the northern part of the area from east to west. Many canals have been constructed in parts of the area for use in oil exploration and production. A large number of drainage canals, bayous and rivers carry fresh water and sediments into the marsh area. The coastline of the marsh area ranges in form from comparatively straight to irregular. The various forms of coastline are classified by Russell (38) as expressions of the forces of land subsidence, deposition and wave erosion. West of Vermilion Bay, where there has been a minimum amount of recent alluviation, the dominance of the forces of wave action has produced a comparatively straight coastline. Remnants of many natural levee ridges along the active delta of the Mississippi River produce an extremely irregular coastline, and reflect the dominance of alluvial deposition over the destructive forces of wave action. The shore line between Vermilion Bay and the Mississippi River shows the dominance of wave action over alluviation and subsidence. In general, the coastal marsh area shows evidences of continuous subsidence with the resultant encroachment of the marsh into the swamp areas and over the subsiding natural levee ridges. Wave erosion is extreme in many places, resulting in the wearing away of large areas of soil materials from the shores of lakes and bays.

This flat coastal area which is subject to inundation by tidal waters and drainage waters from the higher land areas is the site of accumulations of organic materials varying in degrees of decomposition or preservation and in bodies of varying extent and thickness. Subtropical climate and an abundance of water encourage luxuriant plant growth. In the formation of peats, the plants die and fall into the water or are covered with water. Air is excluded and the oxidation processes are limited. The decay that goes on is due largely to anaerobic bacteria (26). In stagnant water there is a rapid accumulation of humic derivatives which produces a toxicity arresting the decay processes (40). The resulting peat is a brown or black fibrous or felty mass of partly decomposed remains of plants in which parts of the original vegetation may be observed. Mucks are formed in similar locations, but with frequent and longer exposures of the plant remains to the air, resulting in complete or nearly complete decomposition of the vegetative tissues. Most of the muck deposits contain large and varying amounts of mineral soil materials.

The inner or northern boundary of the coastal marshes in Cameron and Vermilion parishes is the Pleistocene Coastal Prairie area. The coastal marsh area of the Mississippi delta is bordered on the inner side by natural levee ridges built up by the present and former Mississippi River courses and by the distributary streams of the various sub-deltas (14). In a number of places there are large areas of swamp lands in the marsh area and bordering the marsh on the northern or inner margin. Freshwater swamps and marshes occupy areas along the land-

ward rim of the coastal marsh area in locations receiving fresh water drainage from the higher lands. Clay and silty clay materials not covered or only thinly covered with mucks and peats occupy areas in both the marshes and swamps. These silts and clays occur on the low natural levee ridges along stream channels and in restricted areas of recent alluviation. Silts and clays stratified with thin and thick beds of mucks and peats are commonly found along the coastline in sites where these sediments are frequently reworked by wave and tide action.

The vegetation of the coastal marsh area varies according to the degree of salinity or freshness of the waters received by the different areas, and to the frequency and the length of time saline and fresh waters have dominance in the areas. Marsh vegetation growing in sites dominantly influenced by fresh or nearly fresh waters have a salt tolerance of 0.5 per cent (4, 33). These marsh plants are found on the landward margin of the marshes and in sites receiving sufficient amounts of fresh water to offset the effects of inundations by saline waters. Brackish water vegetation includes plant species which have a tolerance of 0.5 to 2.0 per cent salt. In general, brackish water vegetation occurs along the Gulf and for variable distances in from the coastline in sites which are more frequently inundated by saline waters. Precipitation is usually the only source of fresh water supplied to these areas. Important but usually small areas of marsh land near the coast have a salt water vegetation. Marsh plants growing in these areas have a salt tolerance of 2.0 to 5.0 per cent.

The vast coastal marsh area of Louisiana includes over three and one-half million acres, or more than 12 per cent of the land area of the state (41). The economic importance of the coastal marshes has been recognized since the time of the earliest settlers in the Mississippi River delta. These low, flat, wet areas with their 780,000 acres of trapping lands (29) produce 75 per cent of the muskrats of North America. The combined value of the products of the marshes, lakes, bayous and canals, including furs, fish, oysters and shrimp, provides an annual income of millions of dollars. Additional millions are obtained from the production of oil, gas and sulfur in many parts of the area.

Drainage reclamation of coastal marsh lands has been successful in the western area, west of Vermilion Bay. Rice and pasture crops are successfully grown on reclaimed marsh land in Cameron and Vermilion parishes. In this area, the acreage of reclaimed marsh lands has increased in recent years.

Attempts at reclaiming the eastern marsh lands of the Mississippi delta for agricultural uses have met with little success. Constructing dykes and draining areas of coastal marsh by pumping has been attempted throughout the delta during the past 100 years (27). These drainage reclamation projects have involved large areas of marsh lands

and have cost millions of dollars. Most of these projects were abandoned 25 to 35 years ago. Of 30 reclamation projects begun since 1900, only four are now in use as agricultural lands (17). Rectangular shaped lakes and canals choked with alligator weed and water hyacinth now mark the sites of many abandoned drainage reclamation projects in the coastal marsh. Abandonment of the drainage reclamation projects in this coastal marsh area has been due in a large part to:

1. Soil materials of sites have physical and chemical characteristics unfavorable for profitable agricultural uses.
2. Location of reclamation projects in sites susceptible to inundation by tidal waters and stream floods.
3. Organizations for financing and maintenance of projects were inadequate and inefficient.

The possibilities of successful drainage reclamation of selected parts of the coastal marsh area of the Mississippi delta have not been abandoned in spite of the many costly failures of the past. Enterprising individuals and organizations of progressive business and professional men still look to this area of fertile alluvial soils as the site of future additional agricultural wealth of the state. The increased value of farm lands and higher prices obtained for farm products promote the interest in obtaining more land for agricultural uses.

The following is a report on the detailed soil survey and study of the physical and chemical characteristics of the peats, mucks and clays of the coastal marsh area of St. Mary Parish. The information obtained by this study may be of benefit in making plans for future drainage reclamation of these coastal marsh lands for agricultural uses, and in the development of proper land management practices for the protection and increased production of wildlife (8).

II. COASTAL MARSH AREA OF ST. MARY PARISH

(a) Description of the Area

The coastal marshes of St. Mary Parish have a total area of 229,670 acres, representing nearly 60 per cent of the parish land area. This area lies between the parallels of 29°28' and 29°48' north latitude, and the meridians 91°52'45" and 91°7" west longitude. It is bordered on the south by the Gulf of Mexico and extends inland or northward from the Gulf for distances ranging from 5 to 10 miles. Here it joins the low Mississippi terrace soils of the Teche Ridge. The low natural levee ridges of Bayous Sale and Cypremort cut across the marsh area in a northeast-southwest direction from the Teche Ridge to the Gulf. These higher land extensions into the marsh represent alluvial deposits of the Teche-Mississippi River systems.

The coastal marsh area is a broad, flat plain of very low relief, having an imperceptible slope toward the Gulf. General elevations range from about two feet in the northern or inner parts of the marsh to Gulf level in the southern part. Elevations of six inches to one foot or more occur on the low natural levee ridges along the courses of the tidal channels and other large streams which flow across the marsh. The presence of scrubby or dead hackberry and live oak trees extending from the higher natural levee ridges for considerable distances into the marsh, mark the traces of former ridges which have subsided by their own weight to near or below marsh level. The lower ends and flanks of the natural levee ridges extending into and bordering the marsh land area present a problem of continued agricultural uses. Many of these border areas have subsided to near marsh level, and are inundated by saline waters during times of high tides. On many sugar cane plantations these flanking areas are dyked and the water is removed by pumps. Along the coastline there are extensive removals of soil materials by wave action. During the past two years over 30 feet of soil materials have been eroded from the Bayou Cypremort natural levee where it joins Vermilion Bay.

The most striking topographic features of this area of low relief are the tree-covered salt domes extending high above the marshes. The two salt domes having surface expression in this marsh area are Cote Blanche Island and Belle Isle (42). Cote Blanche Island has a maximum elevation of over 100 feet and an area of 1,608 acres. It is nearly circular in shape, and is located on West Cote Blanche Bay in the southwestern part of the marsh area. Belle Isle, which is located on Atchafalaya Bay east of Wax Lake outlet channel, has a maximum elevation of 80 feet, an area of 240 acres and a roughly triangular shape.

There are large areas of swamp lands occurring within the coastal marsh area of St. Mary Parish and bordering the marsh on the landward side. These swamp lands support a dense to sparse and scrubby tree growth. The dominant tree species include cypress, tupelo gum, swamp maple and swamp bay. The water level in these swamp areas ranges from slightly below the land surface to as much as two feet above the surface.

(b) Drainage

This coastal marsh with its many bayous, lakes and canals is an area having a minimum amount of effective land drainage. Most of the water bodies are at or near Gulf level, and their direction of flow is generally dependent upon the direction and velocity of the winds and the resulting tides. Competent streams flowing gulfward across the marshes include the Atchafalaya River, Wax Lake outlet channel, Bayou Shaffer and Bayou Chene. These streams carry considerable amounts of sediments which are deposited over parts of the marsh and

in the waters of the Gulf. Charenton, Hanson and Wax Lake outlet canals were constructed from Bayou Teche across the marsh to the Gulf. These canals serve to alleviate the dangers of destructive flood waters formerly impounded in Grand and Six Mile lakes and Bayou Teche. The Atchafalaya River along the eastern part of St. Mary Parish is used for commercial and pleasure boat traffic from Six Mile Lake and the Intracoastal Waterway to the Gulf. The Intracoastal Waterway, which crosses the northern part of the marsh area, is the main artery of travel for inland waterway traffic between New Orleans and Orange, Texas. Aside from the many navigable bayous and lakes in the area, there are a number of navigable canals. Many of the small canals have been constructed by and are used by oil exploration companies. Recently a number of canals have been constructed to remove drainage waters from the flanking areas of the low Mississippi terrace ridges.

(c) Climate

This coastal area enjoys a sub-tropical climate. Summer temperatures are high, ranging from 90 to 100 degrees. The fall and spring seasons are warm with temperatures ranging from 60 to 80 degrees. Winters are usually open and cool, with occasionally one or two frosts, but with no below-freezing temperatures for a full day. The average winter temperature is 50 to 60 degrees. For the period 1936 to 1950 the average number of days annually without killing frosts was 294 (6). Daylight hours are long, over 10 hours in December and over 14 hours on June 21.

This coastal area has the highest rainfall of any section of Louisiana. The city of Franklin, which is located about two miles north of the coastal marsh area, has an average annual rainfall of 64.15 inches. The coastal marsh area receives an average of 70 inches of rainfall annually. In summer the average rainfall is 22 to 24 inches, represented by light showers almost daily in some parts of the marsh, and by occasional heavy rains. The average rainfall in winter is 12 to 16 inches, with 16 to 18 inches in the spring and 12 to 14 inches in the fall.

The prevailing wind direction is from the south and southeast. During the hurricane season (August to November) occasional storm winds from the Gulf produce high tidal waves which flood the marsh area to a depth of several feet. Frequently the rise in water level caused by strong southerly and southeasterly winds results in flooding the bayous and canals and reversing the natural direction of flow. It is not unusual for tides to submerge large areas of the marsh to depths of two to six inches.

Good trapping areas are frequently destroyed by the saline waters brought in by high tidal waves (1). Infrequent periods of dry weather produce unfavorable conditions for the muskrat and his food (2).

(d) Inhabitants

The coastal marsh area of St. Mary Parish has few permanent dwellers. Along the Intracoastal Waterway there are a few sturdily built houses on sites high above the marsh level. They are constructed on the spoil-bank materials dredged from the canal. Families living here graze small herds of cattle along the canal banks. Much of their income is derived from trapping, fishing, hunting and working in the oil fields. There are a number of small cabins along the navigable bayous and canals. Few of these are occupied at all times. Most of them are used as temporary camps for a few months each year during the trapping season. Several families live in houseboats along the bayous. Hunting, fishing and trapping are their principal occupations and sources of income.

(e) Economic Value

At present, the major sources of income from the marsh area are furs, seafood and oil and gas production. Two hundred thousand musk-



FIG. 1.—Muskrat house in triangle sedge (*Scirpus olneyi*).

rats, 6,000 mink, 3,000 opossum and 4,000 raccoon were taken from the wet lands of this parish in 1947. This parish produces about 10 million barrels of oil annually, most of which is from the marsh area (36).

Agricultural use of the marsh land area is restricted to grazing small areas of the marsh grasses during favorable seasons.

(f) Peats, Mucks and Clays of the Marsh Area of St. Mary Parish

The soil materials of the marshes of St. Mary Parish are silts, silty clays and clays of recent alluvial origin, and marine silts and clays, overlain in places by peats and mucks varying in thickness from a few inches to more than eleven feet. Classification of the peats and mucks is based on the amounts of organic matter and the degrees of decomposition or preservation of the organic materials. The peats are brown or black, fibrous and woody materials, usually with horizontal or fragmental structure (7). They contain the stems, roots and other parts of organic materials which have not been destroyed by decomposition. They contain from 50 to over 80 per cent of organic matter and have a low content of mineral soil materials. The mucks are usually black or dark gray in color and made up of very finely divided, well-decomposed organic matter. They usually contain from about 15 to 50 per cent of organic materials and varying amounts of mineral soil materials. Muck occurs as a fluid, organic ooze in some small shallow lakes of the marsh area. Muck materials range in thickness from less than two feet to more than six feet over the silts and clays.

Clays in the marsh area have gray or grayish brown clay or silty clay surface layers from 4 to 12 inches in thickness, which contain varying amounts of organic materials. The surface layers are underlain by gray plastic, massive silty clays and clays. Thin lenses of peats and mucks are frequently found at depths of 3 to over 10 feet below the surface. These clay and silty clay soil materials are very similar in color and texture to the Sharkey and Alligator soil series which occur on the low flanking areas of the natural levee ridges of Bayous Sale, Cypremort and Teche. These permanently wet marsh soils differ from the Sharkey and Alligator soils in that they display no soil structure and little evidences of aeration and oxidation. It is possible that subsidence and encroachment of the marsh area over the Sharkey and Alligator soils would result in soil materials having characteristics similar to those of areas of the present marsh clays.

The classification of salinity conditions in the marsh area is based on the salt tolerance of the many species of marsh plants (33). These field classifications of fresh, brackish and saline areas agree in general with the laboratory analyses of many samples of soil materials. Ranges of salinity based on the percentage of salt in the free soil water of the soil materials as determined by Penfound and Hathaway (33) are as follows: Fresh water areas, 0.0 per cent salt; nearly fresh water areas, 0.5 per cent salt; brackish water areas, 0.5 to 2.0 per cent salt; saline areas, 2.0 to 5.0 per cent salt.

Classifications of the soil materials of the marsh area of St. Mary Parish and the acreage of each as determined by the soil survey of the area are as follows:

Brackish peat	44,425 acres
Brackish muck	31,660 acres
Brackish clays	13,875 acres
Nearly fresh water clays and mucky clays.....	44,008 acres
Made land (silts and clays)	8,740 acres

Brackish Peat

In the western part of the coastal marshes of St. Mary Parish there is a large area of marsh peat having a mixed brackish and nearly fresh water vegetation. It is bordered on the east by the swamp fringe of Bayou Sale natural levee, on the north by the swamps bordering the Teche natural levee ridge, and on the south by muck deposits from Little Bay southeast to near South Bend plantation. It is bordered on the south by East Cote Blanche Bay and by West Cote Blanche Bay in the area between Little Bay and Cote Blanche Island. This area of 44,425 acres is lacking in natural drainage with the exception of Black Crook, Cow Island and Bartholomew bayous which are 3, 2 and 4 miles in length, respectively. The Intracoastal Waterway cuts across the northern part of the area. In parts of the area there are a few small canals used for navigation. This area is somewhat protected from the Gulf waters by the intervening Marsh Island. It supports a vigorous growth of both brackish and nearly fresh water plant species. These marsh plants occur as mixed assemblages of nearly fresh and brackish water species, as pure stands of brackish water species over large areas, and pure stands of nearly fresh water species in small areas. There are also a few small areas having a salt water vegetation.

The nearly fresh water vegetation of the peats include cut grass (*Zizaniopsis miliacea*), 3 to 5 feet tall; saw grass (*Mariscus jamaciensis*), 3 feet tall; cattail (*Typha latifolia*), 8 feet tall; delta potato (*Sagittaria lancifolia*), 3 to 4 feet tall.

Freshwater species include paille fine (*Panicum hemitomon*), 2 to 4 feet tall, and cattail (*Typha latifolia*), 8 to 12 feet tall.

Brackish water species include couch grass (*Spartina patens*), 14 to 24 inches tall; big cord grass (*Spartina cynosuroides*), 4 to 6 feet tall; wild cowpea (*Vigna repens*); feather grass (*Panicum virgatum*), 4 feet tall.

The dominant plant species of the marsh vegetation of the peats, height of growth and relative salt tolerance (11, 12, 19, 23, 30, 33) are as follows:



FIG. 2.—Brackish marsh peat 24 inches thick underlain by gray massive clays and silty clays. The vegetation is couch grass (*Spartina patens*), 24 inches tall.

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Panicum hemitomon</i>	paille fine	0	4 ft.
<i>Mariscus jamaciensis</i>	saw grass	0.00 to 0.20	3 ft.
<i>Sagittaria lancifolia</i>	delta potato	0.00 to 0.89	3 ft.
<i>Typha latifolia</i>	cattail	0.00 to 1.13	10-12 ft.
<i>Typha Domingensis</i>	cattail	0.00 to 1.68	8 ft.
<i>Zizaniopsis miliacea</i>	cut grass	0.00 to 0.89	4 ft.
<i>Distichlis spicata</i>	salt grass	0.45 to 4.97	1-1½ ft.
<i>Panicum virgatum</i>	feather grass	0.21 to 2.04	4 ft.
<i>Scirpus olneyi</i>	triangle sedge	0.55 to 1.68	3 ft.
<i>Scirpus robustus</i>	leafy three square	0.64 to 3.91	3 ft.
<i>Spartina cynosuroides</i>	big cord grass	0.55 to 2.04	4-6 ft.
<i>Spartina patens</i>	couch grass	0.12 to 3.91	14-24 in.
<i>Vigna repens</i>	wild cowpea	0.23 to 1.26	
<i>Eleocharis sp.</i>	spike rush	0.15 to 3.03	1-2 ft.

Large areas of the marsh peats occur as almost pure stands of feather grass, triangle sedge, leafy three square, couch grass and big cord grass. Smaller areas have pure stands of paille fine, saw grass, cattail and cut grass. In general, the two mixed assemblages include (1) saw grass, delta potato, feather grass, triangle sedge, spike rush and couch grass, (2) cattail, cutgrass, delta potato and feather grass.



FIG. 3—Cypress stumps and wood excavated from cattail marsh. The stumps and logs were buried beneath two feet of peat.

Description of Brackish Marsh Peat

Sample No. 34. Location: Sec. 40, T. 15S., R. 9E., St. Mary Parish.

1. Mat of roots and other parts of present marsh vegetation with some mixture of black 10 YR 2/1* or very dark grayish brown 10 YR 3/2 finely divided mucky materials. 4 to 8 inches thick.
2. Reddish brown 5 YR 4/4 to dark reddish brown 2.5 YR 3/4 and 5 YR 3/2 coarse to medium textured fibrous peat. Moderate to strong laminated structure. pH 5.5. 64 inches thick.
3. Gray 10 YR 5/1 to 6/1 clay and silty clay, massive structure, plastic and sticky when wet, hard and firm when dry. Contains thin lenses of dark gray 10 YR 4/1 clays and silty clays high in organic matter. pH 6.0. 36 inches or more in thickness.

Vegetation: Big cord grass, 4 feet tall; paille fine, 2 feet tall; delta potato, 6 inches tall.

Range in Characteristics:† Color of peat ranges from dark reddish

*Note: Soil color names adopted by U. S. D. A., B. P. I., Division of Soil Survey 1948; colors of soil moist unless otherwise stated. Symbols express Munsell notations.

†Note: A large number of samples were collected, described and analyzed in

brown 2.5 YR 3/4 to very dark brown 10 YR 2/2. Texture of peat is usually coarse to medium. Structure is usually laminated but some areas have a vertical structure. Surface is covered in places by 2 to 6 inches of muck or mucky peat. Thickness of the peat layer is usually 5 feet, but ranges from 3 to more than 11 feet. Layer No. 3 ranges in color from gray 10 YR 5/1 to 6/1 to dark gray 10 YR 4/1 to 3/1. Strata of mucks and peats are frequently found in this layer at over 5 feet below the surface. There are large areas of former cypress swamp now buried by 18 to 30 inches of peat in the following locations: Range 6E., T. 15S. and R. 9E, T. 15S. See Figure 3.

Brackish Marsh Muck

There are 31,660 acres of muck lands in the marsh area of St. Mary Parish having a mixed vegetation of brackish and nearly fresh plant species. The largest areas of marsh mucks occur west of Bayou Sale ridge in association with the marsh peats. These materials occur in the area along West Cote Blanche Bay between Cypremort Point and Cote Blanche Island; around Hackberry and Mud lakes, and an area lying between the clays and peats along West and East Cote Blanche bays. East of Bayou Sale ridge there are areas of marsh mucks along Horseshoe, Leopard and Blue bayous. The areas of brackish marsh mucks occur along streams or bays in sites having a variable mixture of organic and mineral soil materials. Most areas of marsh mucks occupy sites closer to the Gulf than do the marsh peats. However, there are large areas of nearly fresh to brackish marsh muck southwest of Berwick and on Avoca Island.

The typical brackish water vegetation occurs in mixed assemblages with the nearly fresh water species, and in pure stands. Salt water vegetation occurs in small areas, usually near the coastline.

Dominant plant species of the brackish marsh mucks, their height and relative salt tolerance are listed below:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Typha latifolia</i>	cattail	0.0 to 1.13	7-8 ft.
<i>Sagittaria lancifolia</i>	delta potato	0.0 to 0.89	3 ft.
<i>Typha Domingensis</i>	cattail	0.0 to 1.68	7-8 ft.
<i>Zizaniopsis miliacea</i>	cut grass	0.0 to 0.89	3-4 ft.
<i>Panicum virgatum</i>	feather grass	0.21 to 2.04	3-4 ft.
<i>Scirpus olneyi</i>	triangle sedge	0.55 to 1.68	2-3 ft.
<i>Scirpus robustus</i>	leafy three square	0.64 to 3.91	2-3 ft.
<i>Spartina cynosuroides</i>	big cord grass	0.55 to 2.04	4-6 ft.
<i>Spartina patens</i>	couch grass	0.12 to 3.91	12-24 in.
<i>Vigna repens</i>	wild cowpea	0.23 to 1.26	

this survey. Only a few representative samples are described in detail in this report. Range in Characteristics of the soil materials as used here has reference to the entire survey area.

The following species occur in pure stands in small areas or are a minor part of the plant assemblages:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Panicum hemitomon</i>	paille fine	0	3-4 ft.
<i>Scirpus validus</i>	bulrush	0.0 to 1.13	6-8 ft.
<i>Borrichia frutescens</i>	sea oxeeye	0.87 to 4.43	12-18 in.
<i>Eleocharis sp.</i>	spike rush	0.15 to 3.03	1-2 ft.

Description of Brackish Marsh Muck

Sample No. 24. Location: Sec. 11, T. 17S., R. 9E., east of Salt Point.

1. Mat of roots and other parts of present marsh vegetation; small amounts of very dark gray 10 YR 3/1 to black 10 YR 2/1 finely divided muck materials. 4 to 14 inches thick.
2. Black 10 YR 2/1 to very dark gray 10 YR 3/1 or very dark brown 10 YR 2/2 finely divided muck; contains some partly decayed roots, stems and other parts of marsh plants. pH 3.6. 42 inches thick.
3. Gray 10 YR 2/1 massive clay and silty clay, plastic when wet, hard and firm when dry. pH 3.2. 24 to 72 inches thick.

Vegetation: Paille fine, 4 feet tall; triangle sedge, 3 feet tall; delta potato, 3 feet tall.

Range in Characteristics: Color of the mucks ranges from dark brown to black. With increasing amounts of silt and clay the color is dark grayish brown. Included with the mucks are peaty mucks and silty mucks, the variations due to the amounts of organic matter, degrees of decomposition of organic matter and in the amounts of mineral soil materials. Layer No. 3 ranges from dark gray to gray, and is frequently stratified with lenses of peats and mucks. Thickness of the mucks over the clays ranges from two to ten feet, with an average of three or four feet.

Brackish Marsh Clays

A total of 13,875 acres of clays and silts with a brackish water vegetation occur in the marsh area on the coast along West Cote Blanche Bay, East Cote Blanche Bay, and the coastline area from Point Chevreuil to Grass Island. These sediments occupy a narrow belt along the coast ranging from $\frac{1}{2}$ to $1\frac{1}{2}$ miles in width. Much of this area is made up of alluvial silts and clays which have been reworked and redeposited by waves and tidal waters. Coastline erosion by waves is now active along West and East Cote Blanche bays. These areas are the first to receive waters from the Gulf during times of high tides and are the last areas from which the saline waters recede. They are more frequently

inundated by brackish and saline Gulf waters than other areas in the parish east of Wax Lake Pass. The water level in the marsh clay areas is usually at or only slightly above the land surface. During high tides two to six feet of water inundate these areas. The vegetation of the marsh clays is variable, depending upon the frequency of inundation, the length of time the areas are affected by saline waters and upon the effectiveness of removal of saline conditions by rainfall. It is common to see pure stands of both saline and brackish water vegetation in adjoining small areas, together with some nearly fresh water plant species (23).

Dominant plant species of the brackish marsh clay areas, their height and relative salt tolerance are listed below:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Sagittaria lancifolia</i>	delta potato	0.0 to 0.89	2-3 ft.
<i>Panicum virgatum</i>	feather grass	0.21 to 2.04	3-4 ft.
<i>Scirpus olneyi</i>	triangle sedge	0.55 to 1.68	3 ft.
<i>Spartina cynosuroides</i>	big cord grass	0.55 to 2.04	4-6 ft.
<i>Spartina patens</i>	couch grass	0.21 to 3.91	2-3 ft.

Important plant species which occur as pure stands in small areas or are a minor part of the mixed assemblages:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Typha latifolia</i>	cattail	0.0 to 1.13	8 ft.
<i>Typha Domingensis</i>	cattail	0.0 to 1.68	8-10 ft.
<i>Panicum hemitomon</i>	paille fine	0	3-4 ft.
<i>Eleocharis sp.</i>	spike rush	0.15 to 3.03	1½-2 ft.
<i>Juncus effusus</i>	soft rush	fresh	3 ft.
<i>Borrichia frutescens</i>	sea oxeye	0.87 to 4.43	½-1½ ft.
<i>Distichlis spicata</i>	salt grass	0.45 to 4.97	1-2 ft.

Description of Brackish Marsh Clay

Sample No. 40. Location: On East Cote Blanche Bay, S. 17, T. 16S., R. 9E.

1. Mat of roots, stems and leaves of present marsh vegetation. 2 to 8 inches thick.
2. Dark gray 10 YR 4/1 massive clay containing numerous roots and parts of plants, plastic and sticky when wet. pH 6.1. 10 to 12 inches thick.
3. Gray 10 YR 5/1 to 6/1 massive clay and silty clay; plastic and sticky when wet; hard and firm when dry. pH 6.8. 40 inches to over 120 inches thick.

Vegetation: Couch grass, 30 inches tall; salt grass, 24 inches tall; black rush, *Juncus Roemerianus*, 36 inches tall; wild cowpea; spike rush, 24 inches tall.

Sample No. 15. Location: Near Atchafalaya Bay, T. 17S., R. 10E.

1. Dark gray 10 YR 4/1 massive, plastic clay. pH 6.6. 24 inches thick.
2. Gray 10 YR 5/1 to 6/1 massive clay with thin lenses of massive sandy clay. pH 7.2. 16 inches thick.
3. Gray 10 YR 5/1 and 6/1 with numerous large prominent mottles of brownish yellow 10 YR 6/6 and 6/8 fine sandy loam. pH 7.5. 10 to over 36 inches thick.

Range in Characteristics: The surface layers range from 14 to 24 inches in thickness; surface ranges in color from gray 10 YR 6/1 to very dark gray 10 YR 3/1 to grayish brown 10 YR 5/2. In places there is a mantle of mucky silt or mucky clay at the surface ranging from 2 to 6 inches thick. Layer No. 2 ranges in thickness from 10 to 20 inches and in color from gray to very dark gray. Layer No. 3 ranges in color from gray to dark gray and is commonly stratified clays and silty clays. In the lower part of this layer, lenses of peats and mucks are of common occurrence, particularly along the coastline. Strata of sandy clay and sandy loam occur at below two feet in places, as in Sample No. 15. In color and texture of the soil materials, the Sample No. 15 is similar to the soils of the Harris series.

Nearly Fresh Water Marsh Clays and Mucky Clays

There are 44,008 acres of nearly fresh water marsh clays and mucky clays in the coastal marsh area of St. Mary Parish. These clays and mucky clays extend from Wax Lake on the west to Bayou Chene, the eastern boundary of the parish. This area receives fresh water from the Atchafalaya River by way of Wax Lake outlet channel and the Lower Atchafalaya River, which carry the fresh waters of Six Mile Lake and the rest of the Atchafalaya Basin. These fresh waters and their sediments are distributed throughout the area by many bayous and canals. East of Wax Lake channel the marsh clay material extends in an almost continuous body from the Intracoastal Waterway on the north, southward to the coast. Along the coastline, the marsh clays extend from Wax Lake Pass to the mouth of the Atchafalaya River. The area is low and flat with the exception of the numerous natural levee ridges along the larger streams. These ridges attain a height of one to two feet above Gulf level in places. This area is subject to inundation by saline waters during periods of high tides. These saline waters are rapidly and effectively removed from the area by floods of fresh waters supplied to the area during periods of high rainfall in the Atchafalaya Basin drainage area. Soil materials of the area are alluvial silts, silty clays and clays. The surface materials range in color from brown to gray. This part of the delta has received sediments from both the Red and Mississippi rivers. Some of the recent sediments are brown in color. These brown materials are predominantly Red River sediments carried

into the area by the Atchafalaya River. These brown and gray silty clays and clays are underlain at depths of 12 to 24 inches by gray clays. Buried peats and mucks are found at depths of 5 to 8 feet throughout the area. The vegetation of the marsh clays includes fresh or nearly fresh water species. Small parts of the area have a brackish vegetation.

Dominant plant species of the nearly fresh water marsh clay area, their height and relative salt tolerance are as follows:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Phragmites communis</i>	common reed	0.0 to 2.04	10-12 ft.
<i>Panicum hemitomon</i>	paille fine	0	4-5 ft.
<i>Typha latifolia</i>	cattail	0.0 to 1.13	8 ft.
<i>Sagittaria lancifolia</i>	delta potato	0.0 to 0.89	3-4 ft.
<i>Scirpus validus</i>	bulrush	0.0 to 1.13	5-6 ft.
<i>Spartina cynosuroides</i>	big cord grass	0.55 to 2.04	8 ft.
<i>Zizaniopsis miliacea</i>	cut grass	0.0 to 0.89	3-5 ft.
<i>Panicum virgatum</i>	feather grass	0.21 to 2.04	4-5 ft.

Plant species with pure stands in small areas or representing a small part of the mixed assemblages include:

PLANT SPECIES	COMMON NAME	PER CENT SALT IN SOIL WATER	HEIGHT
<i>Scirpus olneyi</i>	triangle sedge	0.55 to 1.68	3 ft.
<i>Spartina patens</i>	couch grass	0.12 to 3.91	1½-2 ft.
<i>Eleocharis sp.</i>	spike rush	0.15 to 3.03	2-3 ft.

Description of Nearly Fresh Water Clays and Mucky Clays

Sample No. 54. Location: Along Little Doctor's Bayou, Sec. 30, T. 17S; R. 11E.

1. Mat of roots and other parts of plants; with a clay or silty clay matrix. 4 to 12 inches thick.
2. Dark grayish brown 10 YR 4/2 mucky silty clay containing roots and other parts of plants; massive structure; plastic when wet; hard and firm when dry. pH 6.1. 16 inches thick.
3. Dark gray 10 YR 4/1 massive mucky clay; plastic and sticky when wet; hard and firm when dry. pH 6.1. 22 inches thick.
4. Gray 10 YR 6/1 to light gray 2.5 Y 7/0 massive plastic clay. pH 5.0. 36 inches or more in thickness.

Note No. 33. Location: Sec. 27, T. 17S, R. 11E on Round Bayou.

1. Mat of present marsh vegetation. 4 to 8 inches thick.
2. Dark grayish brown 10 YR 4/2 mucky silty clay or mucky clay. 28 inches thick.

3. Dark gray 10 YR 4/1 mucky clay. 12 inches thick.
4. Gray 10 YR 6/1 massive clay, plastic and sticky when wet; hard and firm when dry. Over 24 inches in thickness.

Range in Characteristics: Surface colors range from gray or dark gray to brown. Surface textures range from mucky clay and mucky silty clay to clay. Thickness of surface layers varies from 12 to 48 inches over gray plastic clays. The soil materials of these marsh clays are similar in color and texture to the Alligator and Sharkey soils, differing in the apparent lack of structure and in having water relationships less favorable for aeration.

Made Land in the Marshes

In the coastal marsh area there are 8,740 acres of made land with a marsh vegetation. These soil materials are silts and clays excavated and pumped from the canals during their construction and maintenance. The materials are piled up along the canals and pumped over large areas of the marsh. The largest areas of these soil materials occur along Wax Lake outlet channel and the Intracoastal Waterway. Elevations of these materials range from marsh level to as much as six feet above the marsh.

The following marsh vegetation is presently growing on these areas of made land: common reed, 10 to 15 feet; cut grass, 3 to 6 feet; big cord grass, 6 to 10 feet; wild cowpea; paille fine, 3 to 5 feet; cattail, 7 to 8 feet; feather grass, 4 to 5 feet; delta potato, 3 feet; couch grass, 2 feet tall.

(g) Swamp Lands in the Coastal Marsh Area of St. Mary Parish

Within the coastal marsh area there are 86,962 acres of alluvial silts and clays supporting a dense to scrubby forest cover. These areas are mantled in places with various kinds and amounts of organic materials which are classified as follows:

Swamp peat	26,092 acres
Swamp muck	19,839 acres
Swamp clay	38,756 acres
Made land in swamp.....	2,275 acres

In this area, water stands at or above the land surface most of the time. Large deposits of peats and mucks have accumulated over much of the area. The swamps occur as a fringe area between the high land of the natural levees and the marsh lands in the area west of Bayou Sale ridge. Large swamp areas occur between Bayou Sale ridge and Wax Lake. Swamp lands cover large and small areas between Wax Lake and the Lower Atchafalaya River. These swamp areas occupy sites

which receive an abundance of fresh water from the higher land areas. East of Bayou Sale ridge, the swamp areas are traversed by numerous bayous and canals which carry fresh drainage waters from the higher land areas and from Grand and Six Mile Lakes. Natural levee ridges along the larger streams range in elevation from a few inches to more than two feet above the Gulf level. The swamp areas west of Bayou Sale ridge support a dense growth of cypress and tupelo gum trees. The presence of dead cypress trees in several swamp areas is the result of encroachments of saline waters into the swamps.

In general, the swamps east of Bayou Sale ridge have a less dense growth of smaller and shorter trees than the western swamp areas. In the eastern area, there are some cypress and tupelo gum trees, but the common species include willow, swamp maple, swamp bay, myrtle and button bush (5). Live oak and hackberry trees are commonly found on the low levee ridges along the bayous and on the spoil bank areas of canals. In many places, especially in the southern parts of the swamp area, tree growth is scrubby and thin, and there is little shade. Here the marsh grasses encroach on the swamps, and there is a dense growth of marsh grasses within the swamp areas. The fresh and nearly fresh marsh vegetation growing in the scrubby swamps include the following plant species: lizard's tail, *Saururus cernuus*; bulrush, *Scirpus validus*; delta potato, *Sagittaria lancifolia*; paille fine, *Panicum hemitomon*; cut grass, *Zizaniopsis miliacea*; and cattail, *Typha latifolia*.

Swamp Peat

There are 26,092 acres of swamp peat in the coastal marsh area west of Bayou Sale ridge. These peat deposits are bordered by the marsh on the south or bay side and by the drier wooded areas of Alligator soils along the flanks of the levee ridges of Bayou Sale and Teche. These flat swamps have no well defined natural streams, but are traversed by several major drainage canals. The water level is a few inches over the surface most of the time. Frequently there is $1\frac{1}{2}$ to 2 feet of water over the land surface. Like the adjoining marsh area, the swamps are subject to fluctuations of water level caused by the infrequent high tides. However, during times of storm tides, there is usually sufficient rainfall in the swamp area which, combined with the runoff waters from the higher lands, produces a head of fresh waters sufficient to prevent damaging encroachment of the saline waters into the swamps. North and southwest of Louisa post office, near the Iberia Parish line, are small areas of dead cypress trees which trace the boundaries of encroachment of saline waters into the swamps.

The swamp peats range in color from dark reddish brown 5 YR 3/3 to black 5 YR 2/1. They usually have a granular or fibrous appearance and a coarsely fragmental or blocky structure. They range in thickness from 3 to over 10 feet over clays and silty clays. Buried logs and

stumps are found covered with 18 to 48 inches of peat in large areas. In general, the areas of swamp peat support a dense, tall growth of cypress and tupelo gum trees, with a few willows and swamp maples. The peat swamp is well shaded in most places and has no extensive undergrowth of marsh grasses.

Description of Swamp Peat

Sample No. 88. Location: Near Iberia Parish line, T. 14S., R. 7E. North of Florence Plantation.

1. Dark reddish brown 5 YR 3/3 peat, medium and coarse textured; small blocky or fragmental structure; contains numerous wood fragments. pH 5.4. 84 inches thick.
2. Gray 10 YR 6/1 massive clay and silty clay; sticky and plastic when wet; hard and firm when dry. pH 6.0. 24 to over 48 inches in thickness.

Sample No. 31. Along Thorguson canal, 2½ miles northwest of North Bend Plantation.

1. Dark reddish brown 5 YR 3/3 coarse to medium textured woody peat, having the structural appearance of coarse sawdust; includes fragmental pieces of wood and plant roots. pH 6.3. 48 inches thick.
2. Gray 10 YR 6/1 to light gray 2.5 YR 7/0 clay with thin lenses of dark gray 10 YR 4/1 clay; contains some wood fragments; massive structure; plastic and sticky when wet; hard and firm when dry. Buried stumps and logs throughout this layer. pH 7.0. 36 inches or more thick.

Vegetation: Tupelo gum, swamp maple, cypress (5).

Water 2 feet above land surface at the time this area was observed.

Range in Characteristics: Peat layers range in thickness from 2 to 8 feet and average 4 feet. Surface color usually dark reddish brown, but is very dark brown to black in some places. Structure of peats is usually fine to coarse blocky or fragmental.

Swamp Muck

There are 19,839 acres of swamp muck in the coastal marsh area of St. Mary Parish. Muck soil materials with a woodland cover occupy an extensive area between Wax Lake and Bayou Sale ridge. This area extends roughly from the latitude of the southern end of Wax Lake to the high land south of Shadyside Plantation. The area is crossed by several large bayous which carry fresh drainage waters. The swamp muck area is low and subject to saline water inundation by high tides. However, saline waters are rapidly and effectively flushed out by fresh

water drainage from the ridges on the west and north, and by rainfall in the area. Water is at the surface of the swamp much of the time, and frequently the area is inundated to a depth of one or two feet. Elevations above Gulf level of two feet or less are attained by the levee ridges built up along the channels of the larger streams. The soil materials of this area are alluvial silts and clays overlain by layers of muck or silty muck ranging in thickness from one to eight feet. In places, strata of mucks and peats are found at depths of two to eight feet below the surface. The vegetation of this area is typically more or less open or thin stands of somewhat smaller and shorter trees than are found in the swamp peat soil areas. Tree species include: swamp maple, myrtle, swamp bay and willow, with a few cypress and tupelo gum trees. In the open swamp areas there is a luxuriant growth of fresh water marsh plants which include: lizard's tail, *Saururus cernuus*; delta potato, *Sagittaria lancifolia*; cut grass, *Zizaniopsis miliacea*; and cattail, *Typha latifolia*. Along the low ridges of the bayous and spoil banks of the canals, there are live oak, willow and hackberry trees with an undergrowth of palmetto, *Sabal minor*; wax myrtle, groundselbush, *Baccharis halimifolia*; and marsh elder, *Iva frutescens*. Near the edge of the water, the usual plant assemblages include: groundselbush, marsh elder, myrtle, cut grass, delta potato and bulrush, with water hyacinth and alligator weed growing in the water.

Description of Swamp Muck

Sample No. 27. Location: On a small tributary to Bayou Blue, central part of T. 16S., R. 10E.

1. Very dark gray 10 YR 2/2 or black 10 YR 2/1 finely divided muck containing roots and other parts of swamp and marsh plants. pH 4.6. 18 inches thick.
2. Dark gray 10 YR 4/1 fine textured silty muck; few tree roots. pH 3.8. 54 inches thick.
3. Gray 10 YR 5/1 to 6/1 massive, plastic clay and silty clay. pH 3.8. 38 inches or more in thickness.

Note 2A. Location: South central part of T. 16S., R. 10E.

1. Black 10 YR 2/1 fine textured muck; few roots, leaves and fragments of wood. 48 inches thick.
2. Gray 10 YR 6/1 massive plastic sticky clay.

Vegetation: Swamp maple, willow, button bush, tupelo gum; undergrowth of lizard's tail, delta potato and cattail.

Range in Characteristics: Surface layers range from silty muck to peaty muck. Depth of muck ranges from 12 to 96 inches with an average of 24 to 36 inches. Materials below about 48 inches are usually gray,

wet plastic clays or silty clays. Thin layers of peats and mucks are occasionally found at depths of 6 to 10 feet below the surface.

Swamp Clays and Mucky Clays

There are 38,756 acres of clays and mucky clays with a swamp vegetation in the coastal marsh area of St. Mary Parish. These swamp areas are located east of Wax Lake and on the shores of Grand, Palourde and Six Mile lakes. These silts, silty clays and clays were deposited by streams flowing into the area from the Atchafalaya Basin. The predominantly brown color of the recent sediments indicate that at least a part of these materials are Red River alluvium.

The principal streams carrying alluvium into the area are Wax Lake outlet channel on the west and the Lower Atchafalaya River, Bayou Chene and Bayou Shaffer on the east. These flat swamps have water at or a few inches above the surface most of the time, with occasional depths of two feet over the surface. Elevations of a few inches to over a foot above the Gulf level are attained by levee ridges along the larger streams. Parts of the swamps are inundated by saline waters of high tides resulting from tropical storms. The supplies of fresh water carried into the area and received by rainfall are usually sufficient to flush out the saline waters. However, the southern areas of swamp clays show evidences of increasingly unfavorable conditions for tree growth. Here the cypress and tupelo gum trees are absent. Swamp maple and bay trees are low and small. Other tree species include myrtle and button bush. A dense stand of fresh water plants grows among the trees.

Description of Swamp Clays and Mucky Clays

Sample No. 50. Location: T. 16S., R. 11E., along Cross Bayou.

1. Dark brown 10 YR 4/3 to very dark grayish brown 10 YR 3/2 mucky silty clay; massive structure; plastic and sticky when wet; hard and firm when dry. pH 5.2. 12 inches thick.
2. Gray 10 YR 6/1 massive clay; plastic and sticky when wet. pH 6.1. 84 inches or more in thickness.

Sample No. 64. Location: Along Bayou Chene, S. 36, T. 16S., R. 13E.

1. Dark brown 10 YR 4/3 mottled with gray 10 YR 5/1 massive clay; plastic and sticky when wet. pH 6.1. 12 inches thick.
2. Gray 10 YR 6/1 and dark gray 10 YR 4/1 massive clay; plastic and sticky when wet. pH 5.2. 24 inches or more in thickness.

Vegetation: Swamp maple, willow, myrtle, button bush, few live oaks, few cypress and tupelo gum.

Range in Characteristics: Surface layer No. 1 ranges in color from very dark gray to grayish brown, and in texture from mucky silty clay or mucky clay to clay. In places there is a thin layer (1 to 3 inches thick) of muck on the surface. Layer No. 2 ranges in texture from plastic clay to silty clay; and in color from gray to dark gray. Thick and thin lenses of mucks and peats are found in places at over 4 feet below the surface.

Made Land in the Swamp

There are 2,275 acres of silts and clays along the larger canals, representing soil materials which have been dredged or pumped from the canals during their construction and maintenance. These materials are piled along the sides of the canals or pumped over large areas of swamp lands forming somewhat elevated, artificial ridges in the swamp. The elevations of these areas of made land range from a few inches to as much as 6 feet above the swamp level. Largest areas of made land occur along the Intracoastal Waterway and the Wax Lake outlet channel. These areas support a mixed growth of trees, vines and shrubs which include: hackberry, myrtle, willow, chinaberry, live oak, honey locust, cypress, pecan, yaupon, palmetto, marsh elder, groundselbush, elderberry, rattlebox, blackberry, poke berry, wild grape and honeysuckle.

Swamp Lands. Silts, Sands and Clays

In the extreme northern part of St. Mary Parish there is an area of approximately 13,000 acres of recently deposited silts, sands and clays. These deposits of Mississippi River and Red River alluvium represent a part of the Atchafalaya River delta. Alluvial accumulations during recent years have resulted in the building up of this alluvial fan southward into Grand Lake. Large amounts of alluvium have been deposited in Grand and Six Mile Lakes. This delta area of low relief is subject to frequent inundation by stream overflow. Vegetation of these swamp lands includes willow, cottonwood, cypress and gum trees.

III. LABORATORY STUDIES

(a) Methods of Analysis

The methods used for the analysis of the water soluble salts were essentially those described by A. O. A. C. (3). A portion of the water soluble salts was used to determine calcium, potassium and sodium by the aid of the Perkins-Elmer Flame Photometer, using 200 p.p.m. lithium as the internal standard. The sulfates were determined qualitatively as described by Lunt, *et al.* (25). Iron, aluminum and other heavy metals were present in certain samples, especially those of high acidity, and to determine sulfates by subtraction as described in the A. O. A. C. methods (3) would give erroneous values for the sulfates.

Organic matter was determined as organic carbon by the method described by Kolthoff and Sandell (22), using an electric furnace and a dry stream of oxygen at the rate of 200 ml. per minute. The temperature varied from 800°C for the peats to 930°C for the clays. The water was absorbed in magnesium perchlorate and carbon dioxide absorbed in ascarite. Fifteen minutes were required for complete combustion. The percentage of organic matter was determined by multiplying the percentage of organic carbon by the factor 1.724. This factor was found to be acceptable by Wilson and Stoker (45) for peats.

Nitrogen determinations were essentially as described by Piper (34) except that two selenium granules were added to hasten and give a more complete digestion.

The pH was determined as described by Peech, *et al.* (32), using a glass electrode pH meter.

Silicate analysis was similar to that described by Hillebrand and Lundell (18) for the oxides of silica, iron, aluminum, titanium, calcium, magnesium and manganese with the following exception. Iron was reduced with a G. Frederick Smith zinc spiral instead of hydrogen sulfide. Sulfur and chlorine were determined by the Parr Bomb Method (22). Sodium, potassium and phosphorus determinations were made according to Shapiro and Brannock (39) with the aid of a flame photometer and a colorimeter as described by Fowler, *et al.* (15). The Perkins-Elmer Flame Photometer (21) was used.

The determinations of moisture and loss of ignition were similar to Robinson (37). All calculations listed in these investigations, except the water soluble salts, were made on a moisture free basis. Water soluble salts were calculated on air-dry weight.

(b) Chemical Characteristics of the Soil Materials and Discussion

(In most instances, the tables listed in this discussion are the average values for a group.)

Water Soluble Salts

The water soluble cations and total salt content were quite variable within each group, as shown in Table 1. Calcium, potassium, sodium, sodium chloride and total salt content were higher in the group of marsh clays, mucks, and peats than in the swamp groups. Marsh peats were especially high in the various salts, especially sodium. The sub-surface layers of the marsh and swamp clays and the swamp mucks were generally higher in the various salts of calcium, potassium and sodium than the surface layers. The inverse was true for the marsh mucks and marsh and swamp peats.

Sodium was the predominating water soluble cation of the clays,

TABLE 1. Calcium, Potassium, Sodium, Sodium Chloride and Total Salt Content for Clay, Muck and Peat Samples from the Marsh and Swamp Areas of St. Mary Parish

Material	Location	Depth	No. of samples	Average milligrams per 100 gms. of material				Average NaCl %	Average total salt %
				Ca	K	Na	Total		
Clays:	Marsh:	Surface	21	34	9	115	158	.22	.54
		Subsurface	20	26	14	176	216	.35	.72
	Swamp:	Surface	5	6	5	40	51	.08	.15
		Subsurface	4	10	6	68	84	.11	.26
Mucks:	Marsh:	Surface	29	62	15	182	259	.36	1.11
		Subsurface	23	44	15	182	240	.30	.98
	Swamp:	Surface	6	49	6	45	100	.06	.46
		Subsurface	4	28	15	142	187	.21	.80
Peats:	Marsh:	Surface	2	101	34	980	1109	2.85	3.27
		Subsurface	3	35	22	459	515	1.02	1.66
	Swamp:	Surface	3	32	13	301	347	.81	1.17
		Subsurface	2	8	9	110	127	.27	.28

mucks and peats of both swamp and marsh. It was especially dominant in the mucks and peats of the marsh. Calcium was not especially high in any group. It was highest in the marsh mucks and peats. In all instances, calcium was higher than potassium.

Although not determined, iron compounds were noticed in many of the samples weighed for total salt content, especially the peats and mucks containing high sulfates and sulfides.

Table 1 has been broken down in order to show the distribution of various salts. Groupings were established on the basis of the total salt content as shown in Table 2. It is evident that the group of marsh clays were primarily composed of materials low in various salts, since more than 50 per cent of the samples contained less than 0.5 per cent total salts and less than 10 per cent contained more than 1 per cent. The swamp clays were also low in salt content. As shown by Tables 1 and 2, the surface marsh mucks contained larger amounts of salts than the clays. More than 65 per cent of the marsh mucks contained 1 per cent or more total salt content. The swamp mucks were lower than the swamp peats but higher than the clays. In general, the water soluble salts increased with the organic matter content of the marsh and swamp areas. The marsh groups of clays, mucks and peats contained more total salts than the swamp groups of clays, mucks and peats, respectively.

The subsurface clays, mucks and peats follow a similar salt content distribution as discussed above for the surface materials.

The sulfate content is of particular value to any anticipated agri-

TABLE 2. Distribution of Calcium, Potassium, Sodium, Sodium Chloride and Total Salt Content of the Clays, Mucks and Peats of the Marsh and Swamp Areas of St. Mary Parish

Areas of St. Mary Parish									
Classification	Location	Total salt range %	No. of samples	Milligrams per 100 Grams of Material			NaCl %	Total Salt content %	
				Ca	K	Na			
SURFACE									
Clays:	Marsh	0 -0.5	11	11	4	64	79	0.12	0.24
	.....	0.5-1.0	8	52	13	160	225	.33	.75
	.....	1.0	2	87	23	116	326	.39	1.34
	Swamp	0 -0.5	5	6	5	40	51	.08	.15
Mucks:	Marsh	0 -0.5	5	31	8	73	111	.12	.11
	.....	0.5-1.0	5	72	10	88	171	.15	.84
	.....	1.0	19	68	17	235	320	.49	1.36
	Swamp	0 -0.5	3	13	2	28	43	.05	.16
	.....	0.5-1.0	3	86	9	62	157	.06	.77
Peats:	Marsh	3.0	2	101	34	975	1110	2.85	3.27
	Swamp	0.4	3	32	13	302	347	.81	1.17
SUBSURFACE*									
Clays:	Marsh	0 -0.5	8	9	5	84	98	.16	.28
	.....	0.5-1.0	7	21	14	200	235	.40	.73
	.....	1.0	5	58	26	289	373	.57	1.38
	Swamp	0 -0.5	4	10	6	68	84	.11	.26
Mucks:	Marsh	0 -0.5	4	4	5	96	105	.19	.27
	.....	0.5-1.0	8	23	16	192	231	.30	.78
	.....	1.0	11	73	17	205	295	.34	1.38
	Swamp	0 -0.5	2	4	4	34	42	.04	.12
	.....	1.0	2	52	26	255	333	.37	1.49
Peats:	Marsh	1.0-2.2	3	35	22	459	516	1.02	1.66
	Swamp	0.2-0.4	2	7	9	110	126	.27	.28

* These values comprise the materials underlying the clays, mucks and peats.

cultural reclamation project. Approximately one-half of the marsh clays and all of the swamp clays analyzed were low in water soluble sulfates. As shown in Table 3, a large percentage of the marsh mucks and peats were high in sulfates. The marsh groups were generally a little higher than the swamp groups. Subsurface layers were generally a little higher in sulfates than the surface layers.

Carbonates were not present in the surface or subsurface layers of any group of marsh or swamp clays, peats and mucks.

pH

The pH of the clays varied in the surface layers from 3.2 to 6.6 and in the subsurface from 3.7 to 7.6. A majority of these clays ranged from pH 5 to 6. The pH of the marsh mucks varied from 3.3 to 5.8 in surface layers and from 3.0 to 6.5 in subsurface, with most of the samples ranging from pH 4.0 to 5.5. The subsurface samples were only slightly higher. The pH of the marsh peats was only slightly higher

TABLE 3. Frequency Distribution of Sulfates for the Clays, Mucks and Peats of St. Mary Parish

Material	Location	Depth	Medium					Total samples
			Low (30-120 ppm)	Medium (121-180 ppm)	High (181-250 ppm)	High (251-500 ppm)	Very High (Over 500 ppm)	
Clays:	Marsh:	Surface	11	2	2	2	4	21
		Subsurface	7	1	4	3	5	20
	Swamp:	Surface	5	..	..	..	..	5
		Subsurface	3	..	1	..	..	4
Mucks:	Marsh:	Surface	2	..	..	9	18	29
		Subsurface	4	1	2	4	12	23
	Swamp:	Surface	3	..	..	1	2	6
		Subsurface	2	..	..	..	2	4
Peats:	Marsh:	Surface	1	..	..	..	2	3
		Subsurface	..	..	..	..	2	2
	Swamp:	Surface	..	..	2	..	1	3
		Subsurface	2	..	..	..	..	2

than the marsh mucks but not generally as high as the marsh clays. The pH of the subsurface layers was also slightly higher than the surface peats. In general, the pH of the groups of swamp clays, mucks and peats was higher than the marsh clays, mucks and peats, respectively.

Organic Matter and Nitrogen

The clays, mucks and peats were classified and grouped in Table 4 on the basis of the organic matter content. These analyses indicate that as the organic matter content increased, the ratio of carbon to nitrogen also increased.

Dodson (9) found the peats of Southern Louisiana low in nitrogen. An examination of the data given by Dodson (9), assuming the volatile matter to be composed primarily of organic matter, indicates that the relationship between the organic matter and the nitrogen resembles the woody and fibrous peats of this study. They were also similar to the fibrous peats but unlike the moss peats of New York as described by Wilson (44).

It is also interesting to note from Table 4 that the subsurface materials underlying the mucks and peats were lower in nitrogen than the materials underlying the clays. Apparently, the organic nature of the mucks and peats influenced the nature of the underlying materials. A large percentage of the clays, peats and mucks are underlain with materials containing less than 15 per cent organic matter.

The carbon-nitrogen ratio for the clays ranged from 10:1 to 16:1. Clays containing less than 8 per cent organic matter were very similar in carbon and nitrogen to the soils of the cultivatable area.

TABLE 4. Average Organic Matter and Nitrogen Contents and Carbon-Nitrogen Ratios of Marsh and Swamp Areas of St. Mary Parish

Classification	Location	Range of organic matter (Per cent)	No. of samples	Average organic matter (Per cent)	Average nitrogen (Per cent)	Average C/N ratio
SURFACE						
Clays:	Marsh:	0- 8	8	5.1	0.23	12.7
	.....	8-15	14	11.0	.46	13.7
	Swamp:	0- 8	3	5.6	.24	13.6
	.....	8-15	2	13.8	.58	14.1
Mucks:	Marsh:	15-30	24	21.5	.78	16.1
	.....	30-50	7	37.7	1.31	16.8
	Swamp:	18-32	6	21.4	.77	16.2
Peats:	Marsh:	50+	4	69.2	1.93	20.7
	Swamp:	50+	3	63.3	1.85	20.4
SUBSURFACE*						
Clays:	Marsh:	0- 8	16	4.7	.19	14.4
	.....	8-15	4	11.4	.40	16.8
	Swamp:	0-15	4	8.2	.31	15.6
Mucks:	Marsh:	0-15	24	7.2	.23	18.2
	.....	50+	2	84.6	1.74	28.3
	Swamp:	0-15	4	8.1	.28	16.8
	.....	40	1	40.3	1.17	19.9
Peats:	Marsh:	0-15	3	13.4	.34	23.5
	Swamp:	0-15	1	13.5	.36	21.5
	.....	50+	1	88.8	2.80	18.4

* Subsurface. These values comprise the materials underlying the clays, mucks and peats.

Silicate Analyses

The chemical composition of certain clay, muck and peat profiles shown in Table 5 indicates certain differences between the materials of the marsh and swamp areas. These materials are somewhat different from the materials found in other geological regions. For instance, the mucks of Florida, New York and Pennsylvania are generally underlain by materials high in lime. These materials influence the composition of the surface layers. The materials of lower Louisiana vary from alkaline to highly acid in both surface and subsurface layers.

In many instances, sulfates are very high owing to sea water residues. This is especially true of certain mucks and peats. The sea water also left large quantities of chlorides in certain areas, especially the marsh peats. Many reclamation projects failed because of high sulfates and chlorides left by sea water.

TABLE 5. Silicate Analysis of Clays, Mucks and Peats of St. Mary Parish, Louisiana

Field classification	Location	Lab. No.	Depth	Kind and color of materials*	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	SO ₃	Cl	Ign. loss
			Inches		%	%	%	%	%	%	%	%	%	%	%	%	%
Clays:	Marsh:	15-A	0- 24	DGC	74.29	.69	2.50	12.12	.04	.99	1.16	1.84	1.98	.25	.38	.28	4.36
		-B	24- 40	LGC	74.72	.72	2.65	12.49	.07	.96	1.20	1.88	1.84	.21	.11	.12	3.49
	Swamp:	64-A	0- 12	BrGC	60.21	.89	4.70	16.69	.08	1.14	1.93	2.04	1.19	.28	.53	.22	10.86
		-B	12- 48	GC	56.57	.83	4.41	16.16	.06	1.17	1.94	1.84	1.12	.27	.73	.05	15.67
Mucks:	Marsh:	24-A	0- 48	PM	46.56	.65	4.23	13.38	.04	1.20	1.78	1.44	1.39	.21	4.20	.14	28.70
		-B	48- 60	GC	63.10	.83	4.38	15.55	.03	.77	1.63	1.91	1.52	.19	2.98	.13	9.70
		30-A	0- 36	PM	48.79	.56	2.10	11.75	.03	.97	.97	.90	.93	.20	1.23	.20	32.67
		-B	36- 72	BGC	69.68	.85	2.24	15.01	.03	.92	1.08	1.58	1.35	.14	.10	.03	7.57
	Swamp:	29-A	0- 18	GSM	59.86	.80	2.74	14.32	.05	.73	1.00	1.80	1.24	.15	.40	.07	19.33
		-B	18- 48	BGC	78.37	.82	1.74	12.36	.03	.57	.61	2.10	1.56	.05	.03	.10	3.40
Peats:	Marsh:	32-A	0- 48	PM	48.00	.86	3.91	16.42	.04	1.44	1.82	2.17	1.10	.16	.60	.07	24.97
		85-A	0- 96	FP	7.02	.12	.36	2.36	.02	1.89	1.81	.31	2.85	.07	5.63	2.24	80.58
		-B	96-108	BGC	49.20	.82	5.06	17.48	.04	.95	2.43	2.22	2.28	.07	3.48	1.02	20.91
		91-A	0- 96	P	16.04	.03	1.37	5.95	.02	1.84	1.65	.86	2.48	.13	7.38	1.42	70.15
	Swamp:	31-A	0- 48	FP	30.30	.40	2.05	7.62	.04	1.67	.94	.91	.70	.23	2.18	.07	55.27
		-B	48- 96	W	6.06	.07	.72	2.02	.02	1.20	.58	.13	.33	.26	1.90	.19	89.91
	Swamp:	89-A	0- 60	FP	11.14	.12	1.03	3.10	.02	1.51	1.03	.27	.92	.27	4.25	.70	80.45
		-B	60- 96	LGC	53.64	.80	3.54	17.42	.03	.82	1.96	1.67	1.40	.16	.75	.23	18.48

* Kind and color of materials: B-bluish; Br-brownish; C-clay; F-fibrous; G-gray or grayish; L-light; M-muck or mucky; P-peat or peaty; W-woody material; D-dark; S-silty.

Some peat formations are relatively high in silica from siliceous spines of the fresh water sponges. These formations are usually called "itchy peat." Oxides of iron, aluminum and titanium were generally higher in surface layers of the clays and mucks than peats. These oxides were also generally a little higher in the swamp than marsh. Iron was relatively low in all groups, especially the peats. Titanium was higher in the swamp than the marsh. It was generally high for the swamp and marsh clays and mucks but low for the peats, especially the marsh peats. Manganese was generally low in all groups, especially the peats.

The clays are very similar to those of certain soils of the cultivated area. For instance, laboratory number 64 is similar to the Sharkey silty clay loam analyzed by Holmes and Hearn (20) from Sharkey County, Mississippi. It is not similar to the Sharkey clay loam reported by Reed and Sturgis (35) from Iberia Parish, especially with respect to the oxides of titanium, calcium, magnesium, potassium and sodium.

Calcium was higher in the peats, especially the marsh peats, than in the clays and mucks. This was possibly due to the calcium in the plant residues. Magnesium was quite variable in all groups, ranging from about 1 to 2 per cent.

The potassium content of the swamp and marsh clays and swamp mucks was high while that of the marsh mucks and swamp and marsh peats was low. Sodium content ranged from about 1 to 3 per cent, and was especially high in the marsh clays and marsh peats. The peats from Florida reported by Feustel and Byers (13) were quite different from the peats of Louisiana in that the Florida peats were higher in calcium but lower in magnesium, potassium and sodium.

Manganese and phosphorus are relatively low in all groups, especially the marsh peats.

The clays, mucks and peats are generally underlain with various shades of gray plastic clays or silty clays. As shown in Table 5, these clays were very similar in most respects. Laboratory sample No. 85B was generally higher in iron, magnesium, potassium and sodium than other subsurface clays. However, it is logical to theorize that most of these underlying materials were derived from similar materials during deposition and have been changed somewhat by environmental conditions.

IV. RECLAMATION

The reclamation of wet lands for agricultural uses has been practiced for hundreds of years in Belgium, Holland, Germany, England and other countries (10). Poldering of coastal accretions started about one thousand years ago in the Netherlands. Since 1200, the Dutch have enlarged their country with 233,000 hectares of former foreland, most of the area excellent arable soil (28, 43). The first lake was drained by windmills in the Netherlands during the sixteenth century (46).

In Louisiana, reclamation of wet lands has been practiced since the time of the earliest settlements around New Orleans and along the levee ridges of the many delta streams. Early records of the settlement of New Orleans describe the clearing and draining of swamps and marshes near that city for both building sites and for agricultural uses. To gain more land in times of high crop prices, plantation boundaries were extended back into the swamps and marshes. Interest and enthusiasm of individuals and organizations in drainage reclamation resulted in the construction of a number of large drainage reclamation projects in the periods before and after the Civil War and before and after World War I. The aims of many of these reclamation enthusiasts were directed toward a quick sale of reclaimed land for profit (17). In the coastal marsh area of the Mississippi River delta, many thousands of acres of land have been reclaimed by dyking and pumping. These projects have cost thousands of dollars. Most of these drainage reclamation projects have been complete failures. Of the reclamation projects completed in the delta area during the past 35 years, only four or five have been successful for agricultural uses. Abandoned drainage reclamation projects in the coastal marsh area may be readily located as shallow ponds or lakes on the Quadrangle maps of the U. S. Geological Survey and on aerial photographs of the area.

Drainage reclamation failures in the delta area have been due to a number of factors, among which are included the following: *A. Improper location of projects.* Many of the early reclamation projects were constructed in locations having inadequate protection from flooding by high tides and by stream overflow. *B. Scarcity of information about the soil materials.* Areas were reclaimed without previous investigations or little knowledge of the kinds of soil materials and the physical and chemical characteristics of the soils making up the project areas. Little information was available upon which to predict the agricultural value of the areas after reclamation. Corrections for salinity and acid soil conditions were lengthy and costly processes. *C. Wrong kind of cropping systems.* On many of the projects, general farm crops such as corn, cotton and pastures were found to be unprofitable. More intense agricultural uses of the land such as vegetables and seed production have been practiced on some of the most successful drainage reclamation projects. *D. Unsuitable type of settlers.* Many of the drainage reclamation projects were sold to midwest farmers who had no previous agricultural experiences in the South. These were good farmers, accustomed to the diversified farming of the corn belt area. They were unable to farm the reclaimed marsh lands profitably using the farming methods of the Middle West. *E. Unsatisfactory financing and organization.* Organizations for drainage reclamation construction, maintenance and financing usually placed the financial burden on the farmer-owner.

There were some costly failures due to storm damage to the early drainage reclamation projects of the western coastal marsh area. However, drainage reclamation has been extremely successful in this area in recent years. Large areas of coastal marsh have been successfully reclaimed in Cameron and Vermilion parishes. At the present time, the area of reclaimed land in the western coastal marsh is increasing in size. The principal agricultural crops of this area are rice and pastures.

In St. Mary Parish, drainage reclamation has been a common land management practice in restricted areas of various sizes since the earliest attempts at agricultural uses of the land. Many plantation owners extend the boundaries of their sugar cane lands into the swamps and marshes by constructing dykes and removing the water over the dykes. Before the advent of the water pump, water wheels were used for lifting water over the dykes. At the present time, small and large acreages of land on the low flanks of the natural levee ridges are dyked and pumped and used for the production of sugar cane and rice. Along Grand and Six Mile lakes, there are large areas of swamp lands which represent abandoned drainage reclamation projects. When drained, these areas were productive rice and sugar cane lands. Along U. S. Highway 90, at the west city limits of Berwick, there is an area of 700 acres now in marsh and swamp which produced profitable yields of sugar cane when it was maintained as a drainage reclamation project 25 years ago. Along the flanks of Bayou Sale and Bayou Cypremort ridges, land drainage in general is dependent on the gravity flow of water. Dykes or levees and floodgates are commonly used in these areas to prevent overflow of the cultivated fields during high tides. Owing to land subsidence and encroachment of the swamps and marshes, it has been found necessary to abandon many of these low flanking fields for agricultural uses.

One of the most costly and elaborately planned pump drainage reclamation districts in the delta area was undertaken in the early 1900's at Avoca Island, near Morgan City. In 1911, plans for this project designated an area of 13,200 acres to be reclaimed at a cost of \$300,000. This area was pumped and cultivated in 1913 (31). The project was later expanded to reclaim an additional 3,111 acres, at an increased cost of \$200,000. In 1916, only 20 per cent of this 16,311 acre project was in cultivation. Levees and pumping plants were seriously damaged during the flood of 1927 and the project was abandoned. Avoca Island at present has approximately 2,500 acres of dry land, representing a natural levee ridge of Bayou Boeuf. The original drainage project protected by dykes now includes 4,500 acres of swamp and marsh land. The remainder of this project is now a shallow lake about three feet in depth.

V. CONCLUSIONS

There are important physical and chemical differences between the peats, mucks and clays of the coastal marsh area of St. Mary Parish.

The peats with their high moisture holding capacities and the high contents of undecomposed organic materials are subject to considerable shrinkage and subsidence when drained. The muck soils, which are finely divided and well decomposed, also have high moisture holding capacities but shrink and subside less than the peats. The clays usually contain considerable amounts of organic matter, are rich in most plant food nutrients and are not subject to appreciable shrinking and subsidence when drained.

The marsh peats are generally higher in water soluble calcium, potassium, sodium, chlorides and sulfates than the mucks, which are higher than the clays. Wide variations occur in each group, depending upon location. When comparing the clays, mucks, and peats of the marsh and swamp, marsh profiles generally contain larger quantities of water soluble cations and anions than the swamp. Salts were especially low in the swamp clays. Sulfates were especially high in the marsh mucks and peats.

The pH values of the swamp clay, muck and peat profiles were generally a little higher than those of the marsh, being highest in the clays and lowest in the mucks.

The carbon-nitrogen ratio increased as the organic matter increased and was a little wider in the subsurface than in the surface layers.

Silicate analyses indicated iron, aluminum and titanium oxides were higher in the clays and mucks than in the peats, especially the marsh peats. Manganese and phosphorus were low in all groups, especially the marsh peats. Calcium was highest in the marsh peats. Magnesium was quite variable in each group. Marsh peats were generally low in potassium and high in sodium. Other groups generally contained a somewhat equal distribution of sodium and potassium. Sulfates and chlorides were generally high in the peats and mucks, especially those of the marsh area.

In the marshes, certain characteristic plant species tolerant to different degrees of salinity conditions dominate the different nearly fresh, brackish and saline marsh areas. Plant species and assemblages of plants having a certain salt tolerance may be found in a number of sites where the soil materials and soil waters range from saline to fresh. This condition is due in part to the frequency and length of time the sites are affected by the influences of fresh, brackish or saline waters. The presence of fresh and nearly fresh water plant species in brackish marsh locations is due in some cases to subsidence of the land area and subsequent encroachment of brackish conditions and brackish marsh plant species into sites of fresh water vegetation.

In selecting areas for future reclamation for agricultural uses, the following conditions should be given consideration:

(a) Reclamation projects should be located in easily accessible parts of the coastal marsh area, in sites not subject to flooding by high tides or stream overflow.

(b) Soil areas should be selected which contain minimum amounts of sulfates and chlorides. Swamp clays and nearly fresh to brackish marsh clays and mucky clays are low and moderately low in sulfates, high in organic matter and do not shrink or subside appreciably when drained. These soils have favorable physical and chemical characteristics for agricultural uses after drainage reclamation. The brackish marsh mucks, brackish marsh peats and swamp mucks are generally high in sulfates and usually contain considerable amounts of sodium chloride.

In planning for future drainage reclamation, the value of the natural resources of the coastal marshes should be considered. Drainage destroys the muskrat and the winter feeding grounds for waterfowl. The incomes derived from the agricultural uses of the land after drainage reclamation should be in proportion to the construction and maintenance costs of the reclamation projects.

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LEGEND

MARSH

SWAMP

MARSHLANDS :

- A. BRACKISH PEAT
- B. NEARLY FRESH TO BRACKISH MUCK
- C. BRACKISH CLAY
- D. NEARLY FRESH WATER CLAYS & MUCKY CLAYS
- E. MADE LANDS

SWAMP LANDS :

- F. PEAT
- G. MUCK
- H. CLAY
- I. MADE LANDS
- J. SANDS, SILTS & CLAYS

LOW MISSISSIPPI TERRACE SOILS

K.

DISTRIBUTION OF PEATS,
MUCKS & CLAYS IN THE
COASTAL MARSH AREA OF
ST MARY PARISH







Methods of Planting Coastal Bermuda Grass

At the West Louisiana Experiment Station

BY HAROLD E. HARRIS AND C. B. ROARK

FEB 3 1954

NEW MEXICO STATE
UNIVERSITY



Cows and calves grazing Coastal Bermuda in December

LOUISIANA STATE UNIVERSITY
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AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, Director

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METHODS OF PLANTING COASTAL BERMUDA GRASS

HAROLD E. HARRIS¹ AND C. B. ROARK²

Green grazing during late summer and fall has long been a dream of owners of livestock. This dream is now possible and practical with Coastal Bermuda.

This is a relatively new grass developed at the Coastal Plains Experiment Station at Tifton, Georgia, in cooperation with the USDA.

Georgia farmers were quick to see the merits of this grass, as evidenced by its widespread use in that state.

A five-year grazing test at the Georgia Station resulted in an annual increase of 116 pounds of beef per acre above that from Common Bermuda.

A grazing trial with this grass is now being conducted at this Station, but the purpose of this publication is to describe different methods of propagation.

Coastal Bermuda produces few, if any, viable seed and therefore must be started from vegetation—either sprigs or green grass stems. This grass is well adapted to a wide area. Its drouth and cold resistance add to the length of its growing season in the fall, when green grazing is usually scarce. It is a warm season plant that starts growth in spring and continues to grow until late fall. Coastal Bermuda remains green after most other grasses have turned brown. It may be planted over a long season of the year. Sprigs may be planted from late winter to early fall. Green stems should be planted in summer. This grass puts out long stems which run along the ground; from these, upright stems appear and grow to a height of 12 to 18 inches.

COMPANION CROPS

Pastures with high grazing capacity usually contain one or more grasses associated with at least one legume.

Such a combination gives variety to the grazing, and the legumes add nitrogen to the soil, which helps support the growth of grasses. Grasses help prevent bloat caused by legumes. Clover, lespedeza and Singletary peas have been used for this purpose. The Singletary pea is especially adapted as a companion crop for Coastal Bermuda because of a characteristic enabling the seed to germinate and the young plant to come up through tall grass.

¹Research Associate in Agronomy.

²Superintendent, West Louisiana Experiment Station.

METHODS OF PLANTING

Coastal Bermuda was first hand-planted at this Station in the spring of 1949, from plants supplied by the Tifton Station. Later plantings during that year were made with a tree planter using green stems (green hay). A more recent method of propagation has been the planting of green stems broadcast, on a well-prepared seedbed. Repeated trials planted between showers during summer months have resulted in thick stands. The grass was planted immediately after cutting and before it had time to wilt.

Hand Tools for Plots of 1,000 Stolons

1. For each 1,000 stolons of grass, prepare a seedbed as for water-melons, 8 feet wide and 500 feet in length. A thousand stolons is sufficient to plant four rows 2 feet apart and 2 feet in the drill, the full length of the bed.

2. Spread one load of barnyard manure and apply 400 pounds of 12-12-12 fertilizer per acre, or fertilize according to needs as shown by chemical analysis of the soil. Apply sufficient lime, if needed, to support a companion legume crop. If lime is not available, apply one-fourth to one-half ton of basic slag to the acre.

3. Protect plants from direct sunlight until planted. Keep plants moist and in the shade, covered with wet feed bags or similar cover.

4. Set out plants 2 feet by 2 feet with hand tools.

5. If there is insufficient moisture, plants should be watered as for sweet potatoes.

6. Topdress bed every few weeks with an application of 30 pounds of nitrogen per acre until grass has covered ground.

7. Mow frequently to keep down weeds and to force growth into the horizontal runners.

8. Plant stolons from March 1 to October 1, during cloudy, damp weather.

Tree Planter Method

1. Prepare a seedbed by plowing, disking and leveling.

2. Prior to disking, apply barnyard manure, lime and other fertilizer, according to needs.

3. During early spring, plant sprigs in 2-foot drills, placing as near 2 feet in the drill as possible.

4. Topdress frequently with nitrogen until grass has covered ground.

5. Mow frequently to retard growth of weeds and to force growth of grass into horizontal stems.

Broadcast Planting of Coastal Bermuda



Green stems are distributed evenly with a manure spreader.



Stems are disked in lightly leaving part of grass exposed.

New Growth Following Broadcast Planting



Green shoots of new growth ten days after planting.



Left of hat: Thick stand and good growth 30 days after planting, without irrigation but between showers. Area on right newly planted.

Broadcast Method

1. Prepare and fertilize seedbed as previously described.
2. Select areas of Coastal Bermuda not mixed with Common Bermuda or other grasses.
3. Cut grass when 10 to 12 inches tall, as for hay.
4. Spread grass broadcast rather thickly.
5. Disk in lightly on moist, well-prepared, and heavily fertilized seedbed.
6. Roll with cultipacker.
7. Plant only during damp, cloudy weather. Plant between showers, or irrigate.
8. Mow and fertilize as previously described.

SUMMARY

Coastal Bermuda may be established on a farm by hand, or machine, planting a small area to be used as a source of green stems for later planting on a large area.

The main area may be planted by mowing green stems (hay) and scattering them broadcast. Sufficient stems should be scattered to result in a thick stand within a few days, in order to crowd out other undesirable plants. Only pure Coastal Bermuda stems should be planted, in order to avoid competition from other grasses and in order to have pure Bermuda for further planting. Grass should be kept moving rapidly from the time it is cut until rolled in with a cultipacker, following the disk.

This grass should be disked in lightly, leaving much of the stems exposed, and then rolled with a cultipacker. Bermuda should be planted on a moist seedbed during cloudy, damp weather. Excellent stands have been established without irrigation. However, irrigation will sometimes save stands if no rains fall soon after planting.

Fertilizing heavily before planting and topdressing with nitrogen frequently until ground is covered, will result in a thick stand within a few days.

Frequent mowing forces growth into horizontal stems and hastens ground cover.



Market Egg Flocks in Louisiana

BY
EWELL P. ROY AND JAMES M. BAKER



*Egg washing operation on a commercial-size poultry farm in
Northwest Louisiana.*

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

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Market Egg Flocks in Louisiana¹

EWELL P. ROY AND JAMES M. BAKER

INTRODUCTION

The development of table egg production in Louisiana has been less spectacular than the commercial broiler industry, and efforts in promoting table egg flocks have been less concentrated than those directed toward hatching egg production.² Individual production and marketing patterns have characterized the market egg industry while broiler and hatching egg flocks have been developed more along group or community lines.

Louisiana is a deficit state with respect to the supply of poultry and poultry products. This is true for broilers, hatching eggs and table eggs (Table 1). However, the relative deficit position is more pronounced for market eggs than it is for either broilers or hatching eggs. This does not necessarily mean that Louisiana should be self-sufficient with respect to poultry and poultry products, but it does suggest room for expansion. Present and prospective poultry producers should recognize the cost advantages enjoyed by other areas in such an item as feed, and consider alternative opportunities for the use of their own land, labor, and capital. However, farmers, researchers, administrators, and others need to become aware of the promising position which poultry holds with respect to supplementing the major family income, and recognize that Louisiana has cost advantages over states that must transport poultry products into deficit areas.

From 1950 to 1952 the broiler and the hatching egg segments of the poultry industry in Louisiana showed greater expansion than the market egg enterprise. Little gain is indicated in turkey production for this period.

Table 1. Relative Deficit Position of Different Poultry Enterprises in Louisiana, 1950 Compared with 1952

Type of Poultry Enterprise	Per Capita Use		Per Capita Production in La.		Per Cent Production Was of Use	
	1950	1952*	1950	1952	1950	1952
Farm chickens (lbs.)	17	18	12	11	71	61
Chicks (No.)	5	6	2	3	40	50
Broilers (lbs.)	13	14	3	6	23	43
Table eggs (No.)	399	409	118	140	30	34
Turkeys (lbs.)	6	6	.3	.4	5	7

*Per capita figures assumed to be the same as for average USA per capita consumption.

¹This study is contributive to regional poultry and egg marketing research being conducted co-ordinately by Arkansas, Alabama, Georgia, Louisiana, Mississippi, South Carolina, Tennessee, Texas, Virginia, and Agricultural Marketing Service, U. S. Department of Agriculture. It was supported jointly by State and R.M.A. funds.

²The term "market egg" refers to eggs for human consumption.

Objectives

The over-all purpose of the study was to ascertain the economic status and profitability of the market egg enterprise in the state and to determine the practices that should be modified to increase market egg production in Louisiana. The working objectives were: (1) to determine the location, breed, and management practices used in connection with the market egg flocks studied; (2) to ascertain the patterns and problems of flock replacement; (3) to determine the outlets for the eggs produced and the problems associated with the marketing of eggs by individual producers and by groups of producers; and (4) to provide basic data for future studies dealing with marketing problems beyond the farm, including exploration of the area of consumer acceptance with respect to grade-price relationships and the effect of different types of egg packages on consumer demand as pertain to size and merchandising design.

Method of Study

A list of all commercial egg flockowners having over 250 layers was

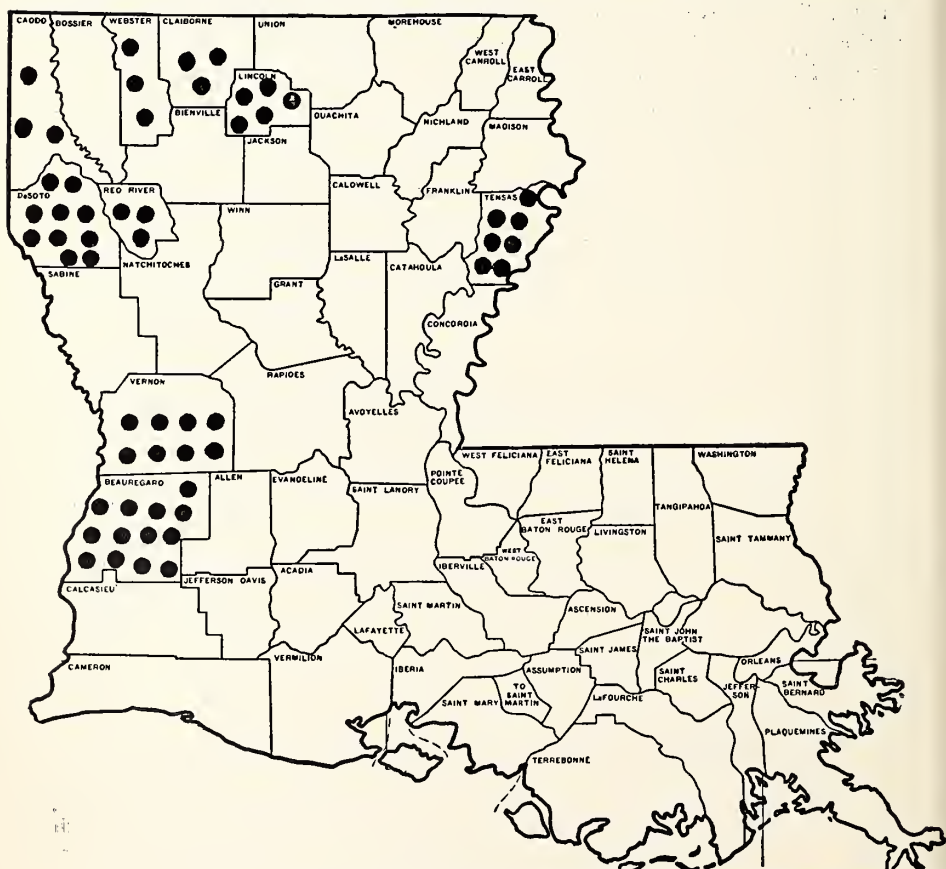


Figure 1. Location of market egg producers surveyed in Louisiana during 1952.

obtained from the 64 county agents in the state, but only parishes reporting 3 or more market egg flocks were included in the study. This limitation was made to determine the economic effects of large flocks on practices and market outlets and to conserve time and funds by eliminating isolated flocks. Fifty-five of the flocks in the parishes selected were surveyed for the desired information. The locations of the flocks are shown in Figure 1.

Status of Egg Producers

Of the 55 Louisiana producers interviewed in 1952, 53 owned their farms and two were tenants (Table 2). For 38 per cent of the producers, poultry and eggs provided the main source of income. Other support of importance was provided by off-farm employment and livestock and dairy enterprises.

Table 2. Tenure and Sources of Income, 55 Market Egg Producers, Louisiana, 1952

Tenure and Income	No. of Producers	Per cent of Total
Tenure:		
Owner	53	96
Renter	2	4
Main Income:		
Poultry and eggs	21	38
Off-farm	13	24
Livestock and dairying	12	22
Crops	8	14
Not ascertained	1	2

The average size of the producer household was three persons. The farms averaged 66 acres with 50 per cent in cultivation and the rest in pasture and woodland. Thirty-nine of the flockowners, or 71 per cent, were farming full-time, while the balance were on a part-time basis.

The average size of the flocks studied was about 1,000 layers. Twenty-four per cent ranged from 250 to 499 in number, 38 per cent from 500 to 999, and 38 per cent consisted of 1,000 or more layers.

FLOCK REPLACEMENT

Eventually all egg producing flocks have to be replaced. The profitable laying period for most hens is less than two years and for many the limit is only one year. Because of this situation, producers generally follow one of three replacement patterns: (1) replace the entire flock at the end of the first year; (2) replace about 75 per cent of the flock at the end of the first year and retain about 25 per cent of the best hens for extension into the second year; and (3) retain all hens beyond the first year with periodic culling.

It was the practice of about 40 per cent of the producers included in this study to replace all of their layers with pullets at the end of the first year, while the remaining 60 per cent replaced varying proportions of

³"Pullets" refers to layers with less than 12 months laying record while "hens" includes those with 12 months and over.

their flocks with pullets at different times during the second year.³ None of the flockowners carried all of their hens into the second year (Table 3). Of the 63,000 layers housed in the selected 55 flocks in the fall of 1952, 88 per cent were pullets and 12 per cent were carry-overs.

Table 3. Method of Flock Replacement Employed by 55 Market Egg Flockowners, Louisiana, 1952

Method	No. of Flocks	Per Cent of Total
Replace all layers with pullets	21	38
Replace with 2/3 pullets—1/3 hens	8	15
Replace with 1/2 pullets—1/2 hens	9	16
Replace with 3/4 pullets—1/4 hens	8	15
Replace with 9/10 pullets—1/10 hens	7	13
Replace with 1/3 pullets—2/3 hens	2	3
Total	55	100

Replacement Patterns Compared

Each of the replacement patterns has its advantages and disadvantages. Some of the advantages of an all-pullet laying flock are a high rate of lay per bird, short, if any, molting period, high percentage of eggs laid in the fall when prices are highest, and less danger of disease development in the flock. The disadvantages include heavy production of small eggs when egg prices are favorable, high replacement cost of layers because of the limited one-year service, interruption of egg production with some probable loss of established markets, and more extensive financial outlay for replacements.

The partial-pullet flock may offer some advantages over the all-pullet flock because the non-layers are removed while normal production continues. Pullets are housed as the hens are culled out intermittently from September to December. Botsford reports that the all-pullet, light-breed flock, although producing eggs at a lower cost, returned a lower egg price, netting a profit of 2.4 cents a dozen, while those having 70 to 99 per cent pullets yielded a margin of 3.7 cents a dozen, and 8.8 cents more per man hour of labor than did the all-pullet flocks.⁴ In the case of the heavy breeds, there are indications that the all-pullet flock may be the more profitable of the two patterns because of the higher liquidating value of the hens as meat.

As to the third replacement pattern, no over-all advantage can be derived from keeping an entire laying flock in production for two years with no replacements, as too few hens will keep up normal production to the end of the period. This replacement method would result in low average lay per hen, depleted market supplies and increased overhead cost.

⁴Botsford, H. E., *The Economics of Poultry Management*, Wiley and Sons, New York, 1952, p. 73.

The extent of flock replacement will be determined mainly by the breed of layer used, rate of culling and mortality of layers, and the cost of rearing the replacements.⁵

Breed of Chicks

Of the 71,500 replacement chicks purchased by the 55 producers visited, 92 per cent were White Leghorns, 6 per cent New Hampshires, and 1 per cent White Plymouth Rocks and Austra-Whites (Table 4). The White Leghorn is the breed most acceptable for producing market eggs in Louisiana. The heavy breeds are used more for producing hatching eggs and for dual-purposes.

Some of the advantages of the light breeds over the heavy breeds in producing eggs for table use in Louisiana are: (1) generally higher rates of lay per hen, (2) lower cost of egg production, (3) market preference for white eggs, and (4) lower cost of replacements. The unfavorable factors are the lower salvage value for the light hen as compared with the heavy one, possibly a higher mortality rate, and more difficult management problems.

Age and Sex at Purchase

Ninety-eight per cent of all Leghorn replacement chicks purchased by the 55 producers were day-old, while only 63 per cent of the New Hampshire breed were of this age. The balance were "started" chicks (Table 4). Owners of heavy-breed flocks probably could more profitably use the "started" chicks, or those ranging from two weeks to seven weeks of age, because often the "started" chicks can be obtained cheaper than they can be raised and better adjustments can be made in flock management by obtaining "started" pullets, which reduces brooding and housing requirements. Some disadvantages are that the pullets find it difficult to adjust to the new environment and mortality is often high, there is a danger of introducing disease with the started chicks, and if chicks are around 6 weeks of age, there still is need for rearing houses, range, and other equipment until they reach laying age. Only 6 per cent of the Leghorns and all of the White Rocks purchased were straight-run (Table 4).

Since White Leghorns have become the principal breed for table egg production, sexed pullet chicks are usually purchased, which reduces the number of cockerels coming from laying flocks. In fact, this supply of poultry meat is getting smaller each year while commercial broiler production is increasing and therefore providing a larger portion of the total poultry meat supply.

Price of Chicks

During 1952, sexed Leghorn pullet chicks cost Louisiana egg producers an average of 34 cents each while straight-run stock cost 15 cents. All other sexed chicks cost 29 cents and straight-run heavy-breed chicks were obtained at 18 cents (Table 4). The price paid for chicks of different

⁵Back, W. B., and Becker, M.H., "Determining the Optimum Annual Rate of Laying Flock Replacement," *Journal of Farm Economics*, Vol. 35, No. 3, August 1953, pp. 414-423.

matings varied from 81 cents to 24 cents. More detailed data on the relationship between matings and price are given in Appendix Table 1, and descriptions of the matings are found in the Appendix.

Seventy-five per cent of the chicks purchased by the 55 producers in 1952 were "certified," or from flocks headed by R.O.P. cockerels, 18 per cent were from "approved" flocks, and the rating of the remaining 7 per cent was not ascertained.

Source of Chicks

Of the 71,500 chicks purchased by the selected Louisiana producers, 75 per cent originated in Texas, 11 per cent in Missouri, 9 per cent in Louisiana, and 2 per cent in Kansas and New Hampshire with the origin of the balance not known. At present there are no indications of increases in Leghorn breeder flocks in Louisiana.

Table 4. Procurement of Replacement Chicks, by Breed, Age, Sex, Price, and Livability, 55 Commercial Egg Flocks, Louisiana, 1952

Breed	Chicks Purchased		Age at Purchase		Sexed & Other		Price of Chicks		Liva- bility ¹
	No.	Pct.	Day-old	Started	Sexed	St. Run	Sexed	St. Run	
			Pct.	Pct.	Pct.	Pct.	Cents	Cents	
Light Breeds:									
White Leghorn	65,900	92	98	2	94	6	34	15	90
Austra-White	1,000	1	100	0	100	0	29	0	88
Heavy Breeds:									
New Hampshire	3,600	6	63	37	100	0	29	0	91
White Ply- mouth Rock	1,000	1	100	0	0	100	0	18	94
Total or Average	71,500	100	96	4	93	7	34	16	90

¹Up to 12 weeks of age.

Chick Mortality

The average mortality rate of the chicks purchased was 10 per cent for the first 10 weeks, with a slightly heavier death loss in the light breeds than in the heavy ones although the difference is probably not significant (Table 4).

Nearly three-fourths of the diseases appearing in the poultry houses were of the respiratory, cannibalistic, and paralytic types (Table 5).

Table 5. Diseases Reported by 55 Market Egg Flock Operators, Louisiana, 1952

Diseases	Number of Times Reported	Per Cent of Total
Colds, bronchitis, coryza, roup	22	37
Cannibalism ¹	14	23
Paralysis, all types	7	12
Pullets' disease or blu-comb	4	7
Pullorum	3	5
Fowl pox	3	5
Chronic enteritis	2	3
Newcastle	2	3
Not ascertained	3	5
Total	60	100

¹Not necessarily a disease but usually a result of defective management.

Outbreaks of Newcastle and fowl pox are reported in Louisiana each year in commercial egg flocks. Considering the catastrophe which these two diseases can cause, it is both wise and economical to vaccinate against them. However 18 per cent and 36 per cent, respectively, of the flocks studied were not vaccinated for pox and Newcastle. The recommended procedure of vaccination for fowl pox is to vaccinate at about 12 weeks of age. A few producers are finding it advisable to vaccinate for bronchitis at 11 or 12 weeks. For Newcastle, intranasal and wing-web vaccinations are recommended at day-old and 13 weeks of age, respectively.

Months Purchased

If pullets are to begin laying during the months of high egg prices they should be obtained as chicks by March 31 and be well in production during September and October. For late spring and early summer production, pullet chicks should be procured preferably in late September or October. Louisiana market egg producers in 1952 bought 84 per cent of their chicks for fall laying and only 16 per cent for late spring laying (Appendix Table 2).

The increasing emphasis on early-summer egg production is a mark of good management. A two-flock system may be desirable where the market outlet entails a year-round demand for eggs. As indicated in Table 6, one flock (A) may be started in October and will commence production the following April and produce large eggs at a time when prices are reaching their peak. Liquidation of the flock can come either in December or later whenever fowl prices are favorable. The spring-hatched flock (B) will commence laying in late August and produce large eggs beginning in October. Disposition of the flock might come in May or later depending on fowl prices, prices of eggs and feed, rates of lay, and molting condition of the layers.

Table 6. Outline for Fall-Hatched and Spring-Hatched Flocks In Maintaining Constant Egg Production

Flock	Time of Hatch	Month Laying Begins	Month Eggs Become Large	Time of Liquidation	Months in Laying Period
A	October	April	June	December and later	9 or more
B	March	August	October	May and later	9 or more

Cost of Rearing Pullets

Data were obtained on the cost of rearing 17,590 White Leghorn pullets to the age of five months by the 55 egg producers contacted. Of the total cost of \$35,679, excluding labor, 73 per cent was for feed, 19 per cent for chicks, and 8 per cent was for medicine, fixed charges, fuel, and litter. The average cost per pullet was \$2.03 (Table 7). Average feed consumption per pullet housed was 25 pounds.

Darrah reports that in New York State in 1951 the cost of rearing a White Leghorn pullet to five months of age, not including labor, was

\$1.69.⁶ The main difference between New York and Louisiana costs was in the price of feed, with New York producers paying \$4.00 per hundred-weight and Louisiana producers paying around \$6.00. The net rearing

Table 7. Cost of Rearing 17,590 White Leghorn Pullets to 5 Months of Age, Louisiana, 1952

Cost Item	Total Cost (Dollars)	Cost per Layer Housed (Dollars)	Per Cent
Feed	26,127	1.49	73
Chicks	6,754	.38	19
Medicine	900	.05	3
Fixed Charges and Misc.	880	.05	3
Fuel	528	.03	1
Litter	490	.03	1
Total	35,679	2.03	100

cost is determined by subtracting the salvage value of the hen at time of liquidation from the gross rearing cost. For example, if a 4.5-pound Leghorn hen sold for 25 cents a pound, the salvage value would be \$1.13. This value subtracted from \$2.03 (gross rearing cost) leaves a net cost of 90 cents per layer. The cost of rearing pullets is affected mainly by the rate of mortality and the cost of feed used.

Laying Age of Pullets

Light-breed pullets usually begin laying four to eight weeks sooner than those of the heavy breeds, which to their advantage shortens the rearing period and lengthens the laying period during the first year. Different methods may be used to induce early laying, such as night lighting and including high percentage of mash in the ration, but caution should be used to avoid bringing pullets into production too early or until they are of good body size.

Of the 52,717 light-breed pullets raised by the selected producers, 36 per cent started production between five and six months of age, while 29 per cent of the heavy-breed pullets began laying at this age, or by the 179th day. By the end of the seventh month, or by the 209th day, 98 per cent of the light-breed birds and 78 per cent of the heavy breeds were laying. By the 210th day all of both breeds were in production (Table 8).

Table 8. Age of Laying, Light Breeds Compared with Heavy Breeds, 55 Market Egg Flocks, Louisiana, 1952

Days	Light Breeds		Cumulative Total Pct.	Heavy Breeds		Cumulative Total Pct.
	No.	Pct.		No.	Pct.	
150 to 179 days	18,978	36	36	842	29	29
180 to 209 days	32,685	62	98	1,422	49	78
210 days and over	1,054	2	100	638	22	100
Total	52,717	100	100	2,902	100	100

⁶Darrah, L. B., and Earle, W., *Handbook of Poultry and Egg Statistics*, Darle Press, Ithaca, N. Y., 1951, p. 62.

FLOCK MANAGEMENT

The management of an egg production enterprise consists of many kinds of tasks with respect to housing, feeding, watering, and related problems. As the size of the flock increases, the problems of management increase with more skill being required to perform the various jobs. Also the conditions under which the replacement pullets are raised and the layers are managed vary from one farm to another. The phases of management given attention in this study include types of houses, source of labor, feeding practices, and methods of financing. The newer system of producing eggs in cages is also discussed.

Types of Laying Houses

Where egg producers raise their own replacement pullets two poultry houses are generally required, one for the laying hens and one for brooding chicks. The laying houses of the producers studied were of three types: (1) 25 houses had dirt floors, metal roofing, wire siding, and good ventilation and were of good construction; (2) 22 of the buildings, though similar in arrangement to the first group, were not of as good quality in construction and ventilation; and (3) the balance were make-shift or temporary buildings, previously used for other purposes. The costs per square foot of floor space for the three different types of houses were 48 cents, 25 cents, and 16 cents, respectively.

The average amount of floor space permitted each layer was 2.7 square feet, which, according to good practice, was not enough. However, this varies by farm since confinement methods differ. Overcrowding is conducive to cannibalism and other troubles. The floor space per house averaged about 2,400 square feet and served 900 layers.

Fresh litter or shavings was used in most of the houses. Automatic drip-type waterers were employed by 38 of the producers, running water by 10, and hand waterers, poorly adapted to the commercial egg enterprise, were in use by the others.

Of the 55 flocks studied, 40 were provided individual nests at the ratio of one nest to four layers, while the remaining 15 had community nests. The former were found to be more acceptable.

Brooding Houses

The brooder houses used on the farms producing market eggs varied too widely in type, size, and construction for comparison. In general they were of acceptable type and cost about 24 cents a square foot, with an average floor space per chick started of .8 square feet, which is near to the recommended 1 square foot for chicks up to 10 weeks of age in Louisiana. After the tenth week, range houses were used extensively, which allowed the growing pullets sufficient space.

Gas brooders were in general use with a few kerosene brooders and infra-red lamps. Some producers used a portion of the laying house for brooding purposes, while a few employed battery brooders. Laying

houses can be used for brooding only when the laying flock is liquidated in March. A sound market egg program no doubt would necessitate separate brooding units, except in cases where satisfactory alternative methods of rearing the pullets are provided. Most flockowners prefer to raise their own replacements and probably can do it as economically as others. Electricity was available to nearly all producers.

Labor Supply

The source of labor for operating an egg flock may be a determining factor in maintaining, expanding, or reducing the size of the enterprise. Aside from management, little highly skilled labor is required in producing market eggs. Therefore, the poultry project can draw heavily on members of the family not fully employed or available for some part-time work. Less than 5 per cent of the labor used by the 55 egg producers interviewed was from sources other than the family (Table 9). These findings are affirmed by a study in Minnesota by Hady and Nodland.⁷

Table 9. Principal Source of Labor on 55 Market Egg Farms, Louisiana, 1952

Source of Labor	No. of Flocks	Per Cent of Total
Operator only	26	48
Operator and others ¹	17	30
Wife	10	18
Hired	2	4
Total	55	100

¹Including wife, children or some hired labor.

The amount of labor required to take care of a laying flock varies with the extent of mechanization, levels of production, and marketing practices. During a 10-month laying period on the 55 farms studied, the amount of labor required for every 500 hens was about 3.5 hours a day, or 1,050 hours for the ten months, or two hours per hen for the laying period.

Much depends, of course, on how well the poultryman is equipped with labor saving devices. Only 2 of the 55 egg producers were using automatic feeders. Considering the relatively small size of flocks and the availability of family labor, it is probable that only a few more of the producers profitably could have used the automatic equipment.

The amount of labor spent in managing a good hen does not differ greatly from that in managing a poor one, except perhaps in handling the extra eggs laid by the better one. If the labor costs were figured at 75 cents per hour, a layer producing 132 eggs would incur a labor cost of 13.7 cents per dozen, while a similar hen laying 204 eggs would incur a cost of only 8.8 cents per dozen (Table 10).

Those producers who market their eggs by "peddling" them to consumers probably do not realize that the labor and time expended beyond the farm duties reduces in like proportion the number of layers that could

⁷Hady, F. T., and Nodland, T., *Our Changing Poultry Enterprise*, Minn. Agr. Exp. Station, Bulletin 409, October, 1951. p. 14, Table 13.

be managed in the flock. Often the premium prices obtained for eggs by this method of marketing may not be high enough to offset the additional cost and inconvenience involved. Also, only a limited number of markets can be obtained in this way.

Table 10. Cost of Labor Per Dozen Eggs Laid, Based on Findings in Study of 55 Market Egg Flocks, Louisiana, 1952

Hours Labor per Layer per 10-Month Period	Eggs Laid in 10-Month Period (Number)	Labor per Dozen Eggs Laid (Minutes)	Labor Cost Per Dozen ¹ (Cents)
2.0	132	10.9	13.6
2.0	144	10.0	12.5
2.0	156	9.2	11.5
2.0	168	8.6	10.8
2.0	180	8.0	10.0
2.0	192	7.5	9.4
2.0	204	7.1	8.9

¹Labor rate at 75 cents per hour.

Laying Rations Used

The most common feeding system followed by the 55 producers was a ration composed of mash and grain, followed by the mash-pellets-grain method, and of lesser importance, the all-mash system. The feeding program used depended much on the brand of feed and the particular recommendations of the feed dealer. The mash-grain ration contained about 60 per cent mash combined with 40 per cent grain, mostly corn or oats. The system of a mash-pellet-grain combination involved the additional feeding of pellets which were a supplement in cases where no range was provided, or when hens were held in confinement. The all-mash system employs no grain feeding. No findings in this study point to the superiority of any one of the three plans. Mash and grain costs are indicated below.

Table 11. Prices Paid for Mash and Grain by 55 Egg Producers, Louisiana, 1952

Mash			Grain		
Method of Purchase	No. of Producers	Dollars Per Cwt.	Kind of Grain	No. of Producers	Dollars Per Cwt.
Retail	41	5.91	Corn	21	4.85
Retail Disc.	8	5.33	Corn-oats	10	4.50
Wholesale	6	5.07	Oats	12	4.25
			Other	12	*
Total	55	5.73	Total	55	4.53

If a poultryman, for example, fed 60 per cent mash and 40 per cent corn purchased at the retail level, his feed cost per hen roughly would have been \$5.49 per hundredweight on the basis of a layer consuming 100 pounds of feed during a 12-month laying period. An 18 per cent protein laying mash is usually fed when the 60-40 plan is used.

Financing the Flock

Forty of the 55 flockowners were financing their chicks, feed, and

supplies through local feed dealers, while the remaining 15 flockowners were either financing their own operations or obtaining loans direct from local banks. It is difficult to obtain financing for commercial egg flocks since the repayment of any loan needs to be delayed for one year because the first six or seven months will be devoted to "rearing" the flock and the remaining five or six months will be needed to net enough to pay the rearing cost. Any loan which requires a complete payment sooner than one year is impractical, and may be harmful to both the borrower and the lender. Repayment plans for buildings and equipment should be spread-out over a three-year period rather than one year. No flock of 500 hens could conceivably pay for their rearing cost and upkeep, liquidate a \$1,500 house and equipment debt in one year, and return the operator any remuneration for his services.

Caged Layers

While none of the flocks studied utilized the caged layer system of management, the method is becoming widely accepted and deserves some mention. The practice is simply to produce eggs in cages rather than on a floor plan. Potential advantages of this system are: (1) lower mortality rates due to less exposure to diseases and parasites, close culling, and elimination of cannibalism and competition among birds; (2) more uniform monthly egg production resulting from frequent pullet replacements and higher rates of lay; (3) more accurate culling based on individual egg production instead of physical appearance of the hen; (4) production of cleaner eggs; and (5) more feasible where land is scarce and rents are high in areas near to urban centers.

Potential disadvantages of the cage system are: (1) the constant problem of providing replacements for the culled layers; (2) problem of fly control and other phases of sanitation; (3) higher initial investment per layer housed; (4) greater incidence of soft-shell eggs; and (5) weather and temperature changes that lead to respiratory troubles.

The initial cost per caged layer is about \$5.00, which consists of \$2.00 for rearing cost, \$1.25 for the cage, and \$1.75 per layer for the housing. This will vary depending on feed, cage, and housing costs. Depreciation of cages over a 10-year period would amount to about 12.5 cents a layer per year. A large portion of the rearing cost of pullets can be recovered by the sale of culled but healthy birds. The house depreciation over a 20-year period would be about 8.75 cents a layer per year. However, repairs and interest on investment are additional costs not considered here.

Lynn Sanborn (of Los Angeles County, Calif.) has stated that: "Eighty per cent of new poultry housing in Los Angeles County for egg production for the past 12 years has been cage construction."⁸

While this system is not likely to supersede floor and range plants on

⁸Sanborn, Lynn D., Farm Advisor, Los Angeles County, Calif., *Personal Communication with the Authors*. October 1, 1953.

the whole, it will supplement production of high quality eggs or compete with them for the market.⁹

MARKETING OF EGGS

The 55 commercial egg producers included in this study during 1952 registered a remarkably high standard in the practices of handling their eggs. Ninety per cent of the flockowners gathered them two or more times daily. This enabled the producer to cool the eggs quicker and minimize losses in quality and breakage. Ninety-five per cent sorted the eggs for size and cleanliness. Market eggs were held in some cool place at the house and packed in either cases or cartons. About three-fourths of the producers marketed their eggs two or more times a week.

None of the flockowners maintained coolers for their eggs. Frequent marketing lessened the need for coolers although they are advisable in any case but especially where groups of producers pool their eggs and move them only once a week (Appendix Table 3). Refrigerated egg rooms are being used more and more for keeping eggs fresh on the farm. In such cases, the washing, candling, and packing can be done in this room. However, in summer months if the egg room is not refrigerated it should be cooled in some way such as with a fan provided the humidity is maintained. Low humidity lowers egg quality. If the eggs are assembled into large enough quantity at one place, some type of refrigeration service should be provided in behalf of all the producers. Such action would be conducive to efficiency and economy.

Only 7 per cent of the producers interviewed candled their eggs and another 7 per cent relied on the dealer or buyer for this service. Most of the producers were not well equipped with marketing equipment although egg scales were common. Mechanical washers were receiving more consideration as volume of production increased.

Outlets for Eggs

About two-thirds of the eggs produced by the 55 flocks were sold through retail food stores, including chain stores. Sales to consumers amounted to 16 per cent and to egg dealers and creameries, 19 per cent (Table 12).

Table 12. Disposition of Eggs by Types of Outlets, 55 Market Egg Flocks, Louisiana, 1952

Type of Outlet	No. of Flocks Patronizing	Per Cent of Total Eggs Sold
Retail Stores	30	65
Individuals	6	16
Egg Dealers	13	12
Creameries	6	7
Total	55	100

Individual Vs. Group Marketing

The egg producer is often confronted with the decision whether to market his eggs alone, in cooperation with other producers, or through

⁹King, D. F., *Laying Cages for Market Egg Production*, Alabama Agr. Exp. Sta., Circ. No. 110, October 1952, p. 29.

private dealers. A limited analysis of the problem was included in this study. Producers selling their eggs individually received an average of 65 cents per dozen in the fall months of 1952, while producers marketing in groups obtained about 58 cents, or 7 cents less (Table 13). The individual sold directly to stores and consumers and the group sold to wholesale outlets. The price differential between the two groups was not so great when marketing large eggs as when marketing small eggs. This was due to the stricter grading in group marketing where smaller eggs are penalized in price. When one markets eggs himself, often the smaller eggs bring relatively more favorable prices than do the larger ones.

Table 13. Comparison of Prices Received for Different Sizes of Eggs, Individual Vs. Group Marketing, 55 Market Egg Flocks, Louisiana, Fall of 1951¹

Size of Egg	Individual Marketing		Group Marketing	
	Price Per Dozen (cents)	Price Per Pound (cents)	Price Per Dozen (cents)	Price Per Pound (cents)
Extra Large	69.6	41.2	66.6	39.5
Large	68.0	45.3	63.4	42.3
Medium	64.0	48.8	55.1	42.0
Small	58.3	52.3	48.0	42.7
Pullet	43.5	46.4	*	*
Average	65.1*	46.9	58.3	41.6

¹Thirty-three marketed individually and 22 through groups.

*Excludes pullet eggs.

Marketing Costs

Producers who take their eggs directly to consumers often neglect to calculate their marketing cost and are apt to claim net price gains over group marketing that actually do not exist. For example, if a producer has 600 layers with a 60 per cent rate of lay, which provides one case a day, or seven cases a week, that producer has to travel 15 miles to town twice a week, the mileage cost amounting to about \$4.80. At least part of two mornings, or about five hours of time, are expended by the operator, which amounts to at least \$3.75. Conservatively calculated, there is a cost of \$8.55 for marketing, or a cost of about 4 cents per dozen. Smith and Trower in a Maryland study reported: "The price received for eggs sold direct to consumers, for example, does not necessarily mean that this method of sale is most profitable. A farmer who has an egg route and delivers eggs has a greater marketing expense."¹⁰

Store Margins in Eggs

Among the stores where the eggs from the 55 producers were marketed, the retail mark-up of eggs in cartons ranged from 5 to 13 cents a dozen. There appeared to be no definite policy as to what the margin should be. A mark-up of 12 cents a dozen when eggs have already been cleaned, sized, cartoned, and transported into the retail store appears to be excessive. Such practices could be corrected by better bargaining

¹⁰Smith, H., and Trower, J., *Relation of Various Egg Marketing Methods To Producer Returns in Maryland*, Md. Agr. Exp. Sta. Bul. A 70, 1951.

power on the part of the producers. These high mark-ups may be borne by either the producer or the consumer or by both. Egg producers can profit little by incurring high production costs and submitting to faulty marketing techniques. The size of net margins between costs and receipts may determine not only the welfare of the producer but also the duration of the commercial egg enterprise.

Cartoning of Eggs

Some producers follow the practice of cartoning only those eggs weighing two ounces or more and packing the smaller eggs in cases. It is claimed that the cost of cartoning can be borne only by the higher-priced eggs. This is especially true in cases where the producer is catering to special customers desiring large, high quality eggs. In some cases, creameries constitute the best market for large eggs while the smaller eggs are shifted to egg dealers and less discriminating markets. Customers on milk routes, finding the eggs handled by the creamery of consistently good quality, often will pay a premium for them over the average run of eggs in the grocery stores. The demand for eggs among the milk-route customers probably fluctuates less than that of grocery store customers.

Some producers carton Grade A eggs of large and medium sizes and retail them to individuals while selling smaller and lower grade eggs to retail stores. Few of the producers contacted followed the grading standards prescribed in the Louisiana laws. They either were not familiar with the regulations or found no advantage in following them. Probably more educational work should be done along this line.

One marketing problem which no doubt will need more research work in Louisiana centers around pullet egg marketing. Often high quality pullet eggs are sacrificed in the early fall because they are poorly displayed or used as loss leaders. Little mention is made of their relatively high quality and price advantage.

Prices Received for Eggs

Most of the eggs disposed of by the 55 flockowners were sold as current receipts with relatively little grading for quality. In the case of individual marketings, the producer and the buyer agreed on a price depending mainly on the local market, while in other cases the price was a constant one for all sizes and qualities throughout the year. Where the producers marketed their eggs in groups, the price often was determined by a margin, such as, "a 3-cent premium per dozen above Baton Rouge current receipt prices," or a price comparable to Grade A Large eggs in the Shreveport, Louisiana, market.

In cases where sales were made to tourists and local individuals, the producer usually asked a premium price because of the small size of purchases. In contrast, however, often under group marketing the egg producer does not find out the exact price for his eggs until several days later when payment is made. This is clearly in the buyer's favor since the

eggs have already been disposed of and the farmer has little, if any, recourse. In one case involving group marketing, eggs were paid for strictly on the basis of size with approximately a 10-cent per dozen spread between large, medium, and small. Under such a marketing method, many of the jumbo and pee-wee eggs have to be sold locally and do not enter the main channels of trade.

The trend in Louisiana seems to narrow down to two basic egg grades: Grade A Large and Canded Current Receipts. The former grade is a "quality" grade while the latter is more of a "price" grade. Limited candling data on current receipt eggs in Baton Rouge indicate that such eggs are generally variable in quality. Sometimes the consumer obtains some Grade A Large eggs in the carton and at other times one is likely to find mostly Grade C's.

Seasonal Prices of Eggs

When eggs are sold directly to individuals, the price remains fairly stable from month to month according to the agreement between the producer and the consumer (Figure 2). Prices paid at grocery stores vary more widely depending mostly on supply conditions. The low price in the spring and the high price in the fall are due to variations in production and the rigid cost of marketing.

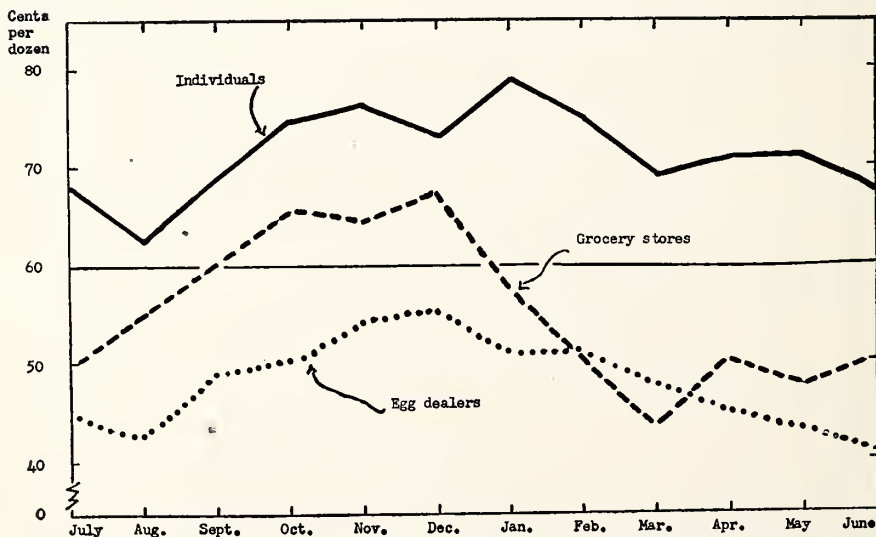


Figure 2. Average prices received for eggs by 55 producers, Louisiana, season 1951-1952

Relation of Egg Size to Price

The Louisiana egg producers received more per pound for small

eggs than they did for large ones, with an inverse relation when referring to price per dozen, as indicated by these comparisons:

	Per Dozen	Per Pound
Extra Large	68.2	40.8
Large	65.9	43.9
Medium	60.0	45.7
Small	53.6	47.6
Pullet	46.3	49.4

Undoubtedly, the main reason for the difference in the two trends in price-size and price-weight relationships is that consumers are more conscious of and more accustomed to buying eggs by the dozen than by the pound. Also it may be that the pattern of serving eggs by number, say two for breakfast, or marketing the smaller eggs as current receipts and the lack of emphasis on the "price per pound" values may cause customers to overlook the fact that large eggs at 66 cents a dozen and 44 cents a pound are a better "buy" than small eggs at 54 cents a dozen and 48 cents a pound. The best value of all would be the extra large eggs at 68 cents a dozen or 40 cents a pound. It is observed that the variation in price per dozen between extra large eggs and pullet eggs was 22 cents and between these sizes in price per pound, 9 cents. Price and size relationships are further shown by Figure 3.

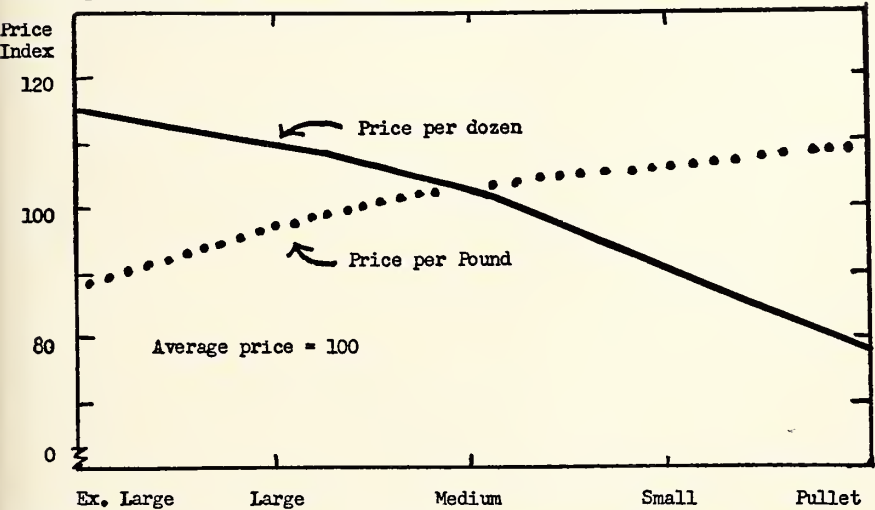


Figure 3. Relation of egg prices to egg sizes, 55 producers, Louisiana, fall of 1952.

The tendency toward a 10-cent differential between Grade A large, medium, and small eggs is indicated in Table 14. Although this differential, which may be established on a purely arbitrary basis, emphasizes size and price relationship, it penalizes the large eggs when values are calculated on a weight basis. A 7-cent difference in price would represent more closely the difference in comparative consumption value.

It often happens that high grade eggs sustain a greater relative price decline than current receipts in the spring months when cheaper country

eggs move into the market. This makes it difficult to establish and maintain a graded and quality-egg program since many customers desert the higher-priced eggs for the lower-priced ones during the season when practically all supplies are fresh.

Table 14. Suggested Price Differentials between Different Sizes of Eggs

Grade A	Estimated Price Per Dozen (cents)	Wt. per Doz. (lbs.)	Cost per Lb. of Egg (cents)	Real Price Per Doz. at 36c Per Pound
Large	60	1.50	40.0	54
Medium	50	1.31	38.2	47
Small	40	1.13	35.4	40

COST AND RETURNS FOR EGGS

The expansion of the commercial egg enterprise in Louisiana will depend largely on a favorable cost-price relationship in eggs. So far, the enterprise has not shown as favorable net returns as other competitive poultry enterprises. While prices for Louisiana eggs have been higher than prices received in some of the other states, it is also true that the cost of producing them has been higher. This of course refers only to the cost-price structure of floor-produced eggs and excludes the economics of cage-egg production. There is not as yet sufficient data in Louisiana to determine whether the caged layer system of producing eggs represents more favorable returns per layer.

The average cost of producing eggs by the 55 Louisiana producers during 1952 was 45 cents a dozen. Feed cost comprised 68 per cent, flock depreciation 14 per cent, and the balance, or 18 per cent, consisted of other production and marketing costs (Table 15). Receipts per dozen averaged 53 cents and miscellaneous credits averaged 1.7 cents. Net returns per dozen were, therefore, 10 cents, and returned a per-hour wage of 73 cents to the operator.

Factors Affecting Costs

Costs of production are affected mainly by cost of feed, rate of lay, size of flock, labor efficiency, mortality, and flock depreciation. Many egg studies have shown the relationship between certain factors and the net return per dozen of eggs produced. Low flock depreciation, low mortality, high labor efficiency, and large-sized flocks all usually lead to higher margins. Only the relationship between feed cost and rate of lay to net returns to producer will be considered in this report.

Cost of Feed

It is rather difficult to establish the true relationship between the price and the quality of a feed. Even chemical analyses are insufficient evidence. Probably the best criteria are controlled experiments in which only the brands of feed comprise the variable factor.

The poultryman must try to secure feeds that are adequate for his purposes and yield the most for the money expended. It may be true

that the highest quality feed is not always the most economical nor is the lowest price feed always the cheapest. An illustration of the possible effects of price of feed on net returns is presented in Figure 4 where it is

Table 15. Costs and Returns per Layer and per Dozen Eggs, 55 Producers, Louisiana, 1952

Returns and Cost Items	Per Layer	Per Dozen Eggs	
	Dollars	Cents	Per Cent of Total
Receipts:			
Eggs Sold	7.81	53.3	96.9
Other ¹	.25	1.7	3.1
Total	8.06	55.0	100.0
Costs:			
Feed ²	4.48	30.5	67.8
Flock Depreciation ³	.90	6.1	13.6
Other Costs ⁴	.75	5.1	11.3
Marketing ⁵	.48	3.3	7.3
Total	6.61	45.0	100.0
Net Returns	1.45	9.9	
Returns per Hour Labor	.73		

¹Includes eggs consumed, feed bags, and manure credits.

²Feed cost consisted of 50 pounds of mash at \$5.90 (retail) and 34 pounds of corn-oats at \$4.50, or an average of \$5.35 per cwt.

³Net cost of pullet refers to gross cost of \$2.03, excluding labor, minus \$1.13 salvage value, or \$.90 net cost, mortality included.

⁴Include interest and depreciation on laying houses, taxes, insurance, litter, equipment charges, cases, utilities, plus some hired labor.

⁵About 81 per cent of the eggs were sold locally so 12 dozens marketed individually at 4 cents per dozen, or 48 cents per layer.

illustrated, for example, that if feed cost per hundredweight were \$4.50, then the average returns per hen would be around \$2.25. If the feed cost \$6.00 per bag the net returns would be only 50 cents per layer. The average net return per layer for Louisiana flocks in 1952 was \$1.45 with

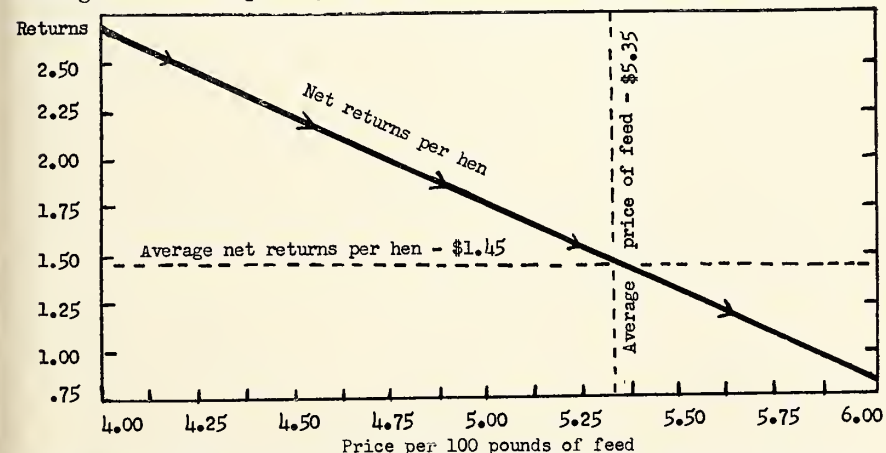


Figure 4. Effects of variations in the price of feed on net returns per hen to producers on the basis of all other costs remaining constant, 55 market egg producers, Louisiana, 1952 (10-month season).

feed cost averaging \$5.35 per hundredweight. Data in Appendix Table 5 further illustrate the effect of varying feed cost on net profit per layer.

Rate of Lay

The average 10-month rate of lay for White Leghorn pullets in the Louisiana flocks surveyed was 176 eggs per layer, or 14.7 dozens. This represented a rate of lay of 58 per cent. The average number of eggs laid per month is shown in Table 16.

Table 16. Rate of Lay, Feed-Egg Ratio, and Percentage Lay by Months, 55 Flocks, Louisiana, 1952

Month	Eggs Laid	Lbs. Feed per Dozen	Per Cent Lay
Aug.	13.0	6.16	34
Sept.	15.8	5.24	53
Oct.	19.2	5.46	62
Nov.	18.9	5.34	63
Dec.	18.4	5.55	59
Jan.	17.9	5.31	58
Feb.	17.5	4.39	62
Mar.h	19.9	4.00	64
April	18.3	4.20	61
May	17.5	4.97	56

Average feed consumption per dozen eggs produced was 5.68 pounds; consequently, the average White Leghorn pullet laying 176 eggs, or 14.7 dozens, consumed about 84 pounds of feed during a 10-month laying period, of which 50 pounds was mash and 34 pounds, grain.

If a layer consumes 84 pounds of grain and mash during a 10-month laying season at an average price of \$5.35 per hundredweight and eggs are sold at 53 cents per dozen, the first 102 eggs will pay for the feed cost. Another 20 eggs at 4.42 cents per egg will have to be laid to cover flock depreciation and another 28 eggs for all other expenses, excluding labor. Therefore, egg profits on the average Louisiana poultry farm begin at about 150 eggs. Anything above that figure represents a return for labor and management. Data in Appendix Table 4 illustrate the effect of rate of lay on feed cost per dozen.

For the comparable 7-month and 10-month laying periods the following rates of lay for the different breeds were recorded. Previous empirical studies have shown that New Hampshires lay fewer eggs than White Leghorns. Hens usually lay fewer but larger eggs than pullets. However, New Hampshires and other heavy breed layers command a higher salvage value than do Leghorns.

Breed and Age	No. of Eggs Laid		Pct. Rate of Lay	
	7-months	10-months	7-months	10-months
White Leghorn Pullets	112	176	53	58
New Hampshire Pullets ¹	104	159	50	53
White Leghorn Hens	93	*	44	*

¹Egg strain.

*No data.

SUMMARY AND CONCLUSIONS

1. Since 1950, floor market egg production in Louisiana has shown little progress. The producers are mostly farm owners and combine poultry raising with off-farm work or other enterprises.

2. The most acceptable method of flock replacement appeared to be one which combined about 75 per cent pullets with 25 per cent of the best hens. The replacement chicks consisted of day-old Leghorn pullets. They were purchased mainly from Texas breeders and cost about 35 cents each. Mortality during the growing period was about 10 per cent. The two-flock system seemed to be advisable where market outlets required a year-round supply of eggs. This means that chicks should be started both in the fall and spring seasons of the year.

3. The cost of growing a replacement pullet in Louisiana during 1952 was \$2.03, excluding family labor charges. The largest cost item was feed, which could be reduced in several ways including more range, lower-priced ingredients, or more home-produced grain. The cost of producing a dozen eggs was 45 cents and the gross return was 55 cents, or a net return of 10 cents a dozen. Flock depreciation was next to feed as a cost item.

4. The management practices on most market egg farms conformed closely to those recommended by LSU Agricultural Experiment Station, except for inadequate floor space per bird. The family was the primary source of labor and the enterprise provided an opportunity to use more fully the existing labor supply.

5. Outlets for eggs consisted mainly of local stores and individuals, which necessitated frequent marketings. A comparison of group vs. individual marketing indicated that producers who marketed their own eggs received more per dozen for them but usually neglected to consider the marketing cost in relation to the alternative use of their time. Carton-ing of eggs by producers was widespread and probably effective in increasing their egg sales and in providing greater convenience for the shopper. The tendency among producers was to use only two grades for eggs: Grade A Large and Canded Current Receipts. No grading on Federal specifications was observed.

6. Relationships between egg size and price were such that small eggs were priced higher per pound than were large eggs. This probably was due to individual marketings where egg size was less important than under a grading program. However, if price differentials based on size were used, then a 7-cent spread between Grade A Large, Grade A Medium and Grade A Small would more accurately reflect the difference than the present and customary 10-cent difference.

7. Although no laying cage flocks were included in this study, indications are that this system will encourage many people to enter table egg production because of its simplicity in management and its adaptability to areas near large consuming centers.

— A P P E N D I X —

Table 1. Price per Chick for Various Matings, Day-old, Sexed Leghorn and Austra-White Chicks, 55 Market Egg Flocks, Louisiana, 1952

Mating ¹	No. of Chicks Bought	Price per Chick (cents)	Per Cent of Total
Star	1,900	81.1	3.1
Imperial	1,500	37.3	2.4
U.S.R.O.P. Candidate	13,300	37.2	21.7
Best Egg	2,000	35.0	3.2
Foundation	1,500	33.0	2.4
No. 1-Double Pedigree	6,250	32.0	10.2
U.S. Certified	18,600	31.9	30.2
AAAA Grade	1,250	31.1	2.0
Not Ascertained	2,800	30.7	4.5
Special	4,500	29.6	7.3
Commercial Certified	1,000	29.0	1.7
Wonderlay	1,000	28.5	1.7
AAA Grade	4,450	24.9	7.2
Royal	1,500	24.0	2.4
Total	61,550	33.8	100.0

¹See Page 26 for definition of terms.

Table 2. Number of Chicks Purchased, by Month, 55 Market Egg Flocks, Louisiana, 1952

Month Chicks Purchased	No. of Chicks Purchased	Per Cent of Total	Cumulative Per Cent
For Fall Laying:			
January	5,550	8	8
February	11,750	16	24
March	40,800	57	81
April	2,250	3	84
Total	60,350	84	84
For Late Spring Laying:			
September	600	1	1
October	10,550	15	16
Total	11,150	16	16
Grand Total	71,150	100	100

Table 3. Selected Egg Handling and Marketing Practices, 55 Market Egg Flocks, Louisiana, 1952

Marketing and Handling Practices	No. of Flocks	Per Cent of Total
Coolers for Eggs:		
Yes	0	0
No	55	100
Place Eggs Held:		
Egg room	20	36
House and Other	35	64
Candle Eggs:		
Yes	4	7
No	47	86
Other	4	7
Equipment Used:		
Egg scale only	28	50
None	19	35
Scale and washer	2	4
Scale and candler	4	7
Washer ¹	2	4
Buyer Pick-up Eggs:		
Yes	15	27
Farmer delivers	37	67
Customer pick-up	3	6
Method of Transport:		
Truck	44	80
Car	8	14
Eggs Picked-up at Home	3	6

¹Mechanical sand-paper brush egg cleaner.

Table 4. Necessary Price per Dozen for Eggs to Cover Feed Costs, with Varying Rates of Lay and Feed Prices per Hundredweight, 55 Louisiana Producers, 1952

No. of Dozen Eggs Laid per 100-lbs. Feed	COST OF RATION (DOLLARS PER CWT.)							
	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.25
Necessary Price Per Dozen Eggs in Cents to Cover Feed Costs								
20.0	22	24	25	26	28	29	30	31
19.0	24	25	26	28	29	30	32	33
18.0	25	26	28	29	31	32	33	25
17.5	26	27	29	30	31	33	34	36
17.0	27	28	29	31	32	34	35	37
16.0	28	30	31	33	34	36	38	39
15.0	30	32	33	35	37	38	40	42
14.0	32	34	36	38	39	41	43	45
13.0	35	37	38	40	42	44	46	48
12.0	38	40	42	44	46	48	50	52
11.0	41	43	45	48	50	52	55	47
10.0	45	48	50	53	55	58	60	63

Table 5. Net Profit or Loss per Layer at Different Levels of Feed Cost and Average Receipts per Dozen Eggs, 55 Producers, Louisiana, 1952

Average Price Per Dozen (cents)	Cwt. Feed Cost (\$)	Egg-Feed Ratio *	Total Cost Per Bird (\$)**	Total Rec. Per Bird (\$)**	Net Profit Or Loss (\$)
40	6.00	1:15	7.17	5.87	-1.30
	5.50	1:14	6.75	5.87	-.88
	5.00	1:13	6.33	5.87	-.46
	4.50	1:11	5.91	5.87	-.04
	4.00	1:10	5.49	5.87	+.38
45	6.00	1:13	7.17	6.60	-.57
	5.50	1:12	6.75	6.60	-.15
	5.00	1:11	6.33	6.60	+.27
	4.50	1:10	5.91	6.60	+.69
	4.00	1:9	5.49	6.60	+1.11
50	6.00	1:12	7.17	7.34	+.17
	5.50	1:11	6.75	7.34	+.59
	5.00	1:10	6.33	7.34	+1.01
	4.50	1:9	5.91	7.34	+1.43
	4.00	1:8	5.49	7.34	+1.85
55	6.00	1:11	7.17	8.07	+.90
	5.50	1:10	6.75	8.07	+1.32
	5.00	1:9	6.33	8.07	+1.74
	4.50	1:8	5.91	8.07	+2.16
	4.00	1:7	5.49	8.07	+2.58

* The no. of dozens of eggs needed to buy 100-lbs. of feed.

** Feed cost per layer plus other costs of \$2.13.

*** Eggs laid (176) times price per dozen. Assumed that number of eggs laid per cwt. of feed is the same at all feed cost levels.

*Description of Matings and Prices Paid as Appears in Appendix Table 1.**

1. *Star*: "Chicks from hens with trapnest records from 250 to 355 eggs in one year and headed by males from hens with records of 325 to 355 eggs in one year. Pullets from this mating should average better than 260 eggs each during their first production year."

2. *Imperial*: "This mating includes all of my R.O.P. Candidates and several thousand of two, three and four-year-old hens. Males come from Star Matings with R.O.P. records of 300-355 eggs each. Pullets from this mating should average 240 eggs and above."

3. *U.S.R.O.P. Candidate*: "Each breeding hen with individual pedigree record of 250-344 eggs and better has been carefully selected. Males are from U.S. R.O.P. dams of 275 egg record and better."

4. *Best Egg*: "From pedigreed sires mated to carefully selected heavy producing hens. Chicks carry 50 per cent or more of U.S.R.O.P. strain blood."

5. *Foundation*: "Chicks are carefully selected for High Egg Production and Large Body Size. You will find in this mating larger-bodied with greater flock laying ability than many AAAA or extra high quality chicks."

6. *Mating No. 1 Double Pedigree*: "They are Double-Pedigree mating in that

*Descriptions of matings were obtained from the literature of the individual breeders concerned and are private brands or terms of no recognized, uniform quality except U. S. R. O. P. Candidate and U. S. Certified Matings.

both the hens and roosters are direct out of the birds in our individual pedigree mating. All of the birds in this mating are individual pedigree wingbanded individuals. They have definite egg production bred into them. Almost all of the hens in this mating are daughters of hens with an egg record of 210 to 277 eggs in 300 days or 250 to 335 eggs in 365 days, the exception being a few that are from individual matings of some of our last year's R.O.P. Candidates.

"The males used to head this mating are all Individual Pedigree R.O.P. cockerels from hens that have laid at a rate of from 66.6 per cent for either a 300 or 365 day period. About the only difference between this mating and the R.O.P. Candidate mating is that they are not being trapnested."

7. *U.S. Certified Mating*: "All dams are from Star and Individual Matings of U.S.R.O.P. hens of 200-300 egg record and better. Sires are individually pedigreed U.S.R.O.P. males from dams with official records of 250-300 eggs and better."

8. *AAAA Grade*: (a) "From our best hens with high egg-production and show qualities." (b) "Hens from these breeding flocks, or closely associated breeding flocks of equal quality, are mated with R.O.P. Wing Banded, pedigree bred males out of hens with records of 225 to 310 eggs per year. Every breeder is blood tested for Pullorum, individually examined and legbanded, rigidly culled, and only the best birds are allowed to remain as breeders."

9. *"Special" Mating*: "The males siring this grade are produced from pedigreed sires. These males are vigorous, and of good standard type and color. They do not carry the direct high egg record blood lines of the pedigreed males used to sire our Best Egg grade chicks. The hens in this grade are selected for color, type, vigor, and egg producing ability. All eggs set for this grade must weigh 23 ounces or more per dozen."

10. *Commercial Certified Mating*: "These contain only fully developed hens that have been carefully selected and up to standard for the production of U.S. Certified Chicks. They are from our best breeding hens and are mated to individual pedigreed R.O.P. cockerels of our own breeding. No individual egg is set weighing less than 1 11/12 oz. and the eggs must average at least 24 oz. per dozen."

11. *Wonderlay*: "Hens in this mating should lay 75 to 125 more eggs than you would get from common grade chicks. Every bird is closely inspected by licensed state poultry inspectors, operating under the National Poultry Improvement Plan. Every hen is pullorum tested, and every flock held to zero reaction.

"The Wonderlay Mating chicks are well above average, and thousands of customers raise them year after year, and know they will make a profit. Many broiler plants use Wonderlay Mating cockerel chicks because they are closely culled and guaranteed livability."

12. *AAA Grade*: (a) "Chicks from High-Producing Standard Pure Bred Chickens." (b) "This grade is between our 'AAAA' and 'Standard' grades in quality. Too good for listing as 'Standard' and not good enough to list as 'AAAA' best grade."

13. *Royal*: "Royal Mating chicks are produced from hens of high egg laying capacity, second only to our All-Star stock, mated with high quality cockerels. Our Royal Matings represent the cream of our heaviest laying U.S. Approved Pullorum Passed supply flocks. Royal Matings are in great demand for high commercial egg production, for fine breeding cockerels, for improving the quality of your stock."



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Growing Market Turkeys in Louisiana

By

CHAS. W. UPP, J. L. HEATH, AND R. S. WOODWARD



*Beltsville White Turkeys on Native Grass Pasture at the
North Louisiana Experiment Station, Calhoun*

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

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Growing Market Turkeys in Louisiana *

CHAS. W. UPP, *Poultry Industry Department, L.S.U.*; J. L. HEATH
AND R. S. WOODWARD, *North Louisiana Experiment Station*

INTRODUCTION

Louisiana farmers do not produce enough turkeys. This dogmatic statement is not meant to imply that Louisiana should become a turkey "exporting" state or to claim that all turkeys consumed in Louisiana should be produced in the state. Rather it is the purpose of this bulletin to present evidence that turkey production can become a more substantial and profitable source of income on many Louisiana farms. To date only a small percentage of the turkey consumption needs of the state is produced locally. Roy and Baker (unpublished data Dec., 1953) note that in 1952 only 7 per cent of the turkeys consumed in this state were produced herein. Over a period of years Louisiana producers have found turkey production to be a profitable enterprise. Many farmers believe that turkeys are "hard to raise," yet with simple equipment and grown by a man without previous experience with turkeys, profitable results were obtained for each of the seven years during which experiments were conducted at the North Louisiana Experiment Station at Calhoun. Turkeys in these tests were not produced on a large commercial scale but rather in small flocks such as might be grown on most Louisiana farms. The number grown averaged 244 poults per year and ranged from 172 to 346. A total of 1,711 turkeys was started during the seven years. Eighty per cent of the poults started were grown to market age.

TESTS INCLUDED

A series of tests was conducted during the course of these experiments at the North Louisiana Experiment Station (Calhoun). These involved such matters as keeping turkeys in confinement versus growing them on range; the use of simple versus complex growing mash; study of different pasture crops; marketing turkeys at different ages, and the

*These experiments were conducted at the North Louisiana Experiment Station (Calhoun) by J. L. Heath under the supervision of R. S. Woodward. C. W. Upp conferred with them, helped summarize the data, and prepared the manuscript. Numerous other staff members participated in these experiments. Acknowledgment is made of the assistance of H. E. Hathaway, B.A. Tower, and D. M. Johns. Others have assisted in one way or another.

comparison of two different breeds of turkeys. Information was collected on individual weights of turkeys at four-week intervals from one-day-old to market age. Records were kept of lot (or group) feed consumption by four-week periods and total feed consumption was calculated per turkey (by kind of feed). Feed utilization was determined, i.e., pounds of feed required to produce a pound of turkey. All feed consumed including that by poults culled or that died was charged to the turkeys marketed. Records of mortality and culling were maintained throughout the growing period, and viability, or per cent of turkeys marketed of the poults started, was calculated for each group. Hauling shrinkage was determined for some groups. The quality of the turkeys marketed was noted, and processing losses, yields of drawn carcass, giblets, etc., were recorded.

BRIEF DISCUSSION OF RESULTS

It is evident that a discussion of the detailed results for each year would be too long and tedious to be of interest. Rather, only some of the highlights of the results of different years are given. In addition some observations based on the entire series of tests are presented. The tabular material is not presented in full nor discussed in detail but has been summarized and is presented in the Appendix.

Considering the fact that the men taking care of the turkeys had had no previous "turkey" experience the viability during the first two seasons was quite good. In 1945, 85.7 per cent and in 1946, 80.7 per cent of the poults started were marketed. A common problem faced was to get the poults to start eating. Various devices were used successfully for different lots such as placing a few started chicks (or poults) in each lot, scattering tender green feed on top of the mash, placing mash on egg flats, and the use of colored marbles in the mash trough. There was some tendency for the poults to crowd into corners, etc. until a restraining circular barrier was placed about 2-2½ feet beyond the edge of the hover for about the first week.

During most years the turkeys were graded alive and again after processed, by licensed graders. The quality of the turkeys produced was entirely satisfactory, most of them grading A or AA. Late hatched poults (one year) and marketing too early (another year) adversely affected the quality. The varying weather for the different seasons also affected the "finish" obtained.

The margin of income over feed and poult costs was quite encouraging, averaging \$2.00 in 1945 and \$1.75 in 1946. Actual feed and poult costs and conservative wholesale prices were used in calculating margin of income, although some turkeys were sold at higher prices. For one year, 1947, a simple growing mash (composed of 25 per cent yellow corn meal, 25 per cent dehydrated sweet potato meal, 15 per cent each of ground oats, meat scrap, and cottonseed meal and 5 per cent dried milk) was compared to a more complex (and orthodox) mash for turkeys

grown on range. The turkeys in addition had corn, oats, oyster shell, and grit free choice. No difference was noted in growth rate, mortality or quality of the turkeys in the two lots.

The smaller family-size Beltsville Small Whites were well received on the market, both sexes selling as high or higher than hens of the larger breed. Decreased poundage for a given number of turkeys necessarily resulted when the smaller breed was grown. As pointed out later, feed utilization was somewhat less efficient and processing losses higher for the Beltsville Whites. The requirements of the particular market are an important consideration in deciding which breed to produce.

In these tests pasture appeared to be worth fifty cents to one dollar per turkey by lowering feed costs as compared to confinement rearing. The season (weather) affected the value of the pasture. Comparative feed wastage of confined and range grown turkeys likewise may well have been a factor.

Cooking tests were conducted (by housewives) on a limited scale to determine cooking losses that might be expected. The variability of the results indicated the quite different temperatures, methods, and length of time of cooking that were used. In one such test the weight of the carcass after cooking averaged 77.6 per cent of the precooked weight, varying from a high of 88 per cent to a low of 68.6 per cent. When drippings were included with carcass weight the average was 82.8 per cent of precooked weight, varying from 92 per cent to 78.2 per cent.

To test the effects, if any, of using different grains to supplement growing mash (and pasture), one lot in 1949 received corn only, another oats only, and a third was given both corn and oats. No great difference in margin of income resulted although the corn lot averaged about 35 cents more per turkey in this single test. Feed cost was slightly lower in the corn lot.

The disadvantage of selling turkeys before they are finished is indicated by a test in which Beltsville Whites were dressed out at 20 weeks and others at 24 weeks of age. The oven-dressed weights averaged from 75.6 per cent to 78 per cent for the lots of 20-week-old birds and 78.4 per cent to 80.5 per cent for the 24-week birds. The grades, in fleshing and finish, were higher for the lots of turkeys that were 24 weeks old.

Three types of pastures were used for Beltsville Whites in 1950. Native grass pasture was used in one, soybeans and cowpeas in a second and Sudan grass in a third pasture. No marked differences were obtained in growth rate or feed utilization.

Based on seven year's experience the labor required to care for 300 turkeys to market age (28 weeks) was estimated at 120 man hours (equivalent to 12 days). This includes time spent in brooding, feeding, routine care, and marketing at wholesale. To sell the turkeys at retail (processed) would require an additional 60 to 75 hours.

The last year of the experiments, 1951, proved to be a bad or "hard luck" year. Although poults had to be replaced and a loss was ex-

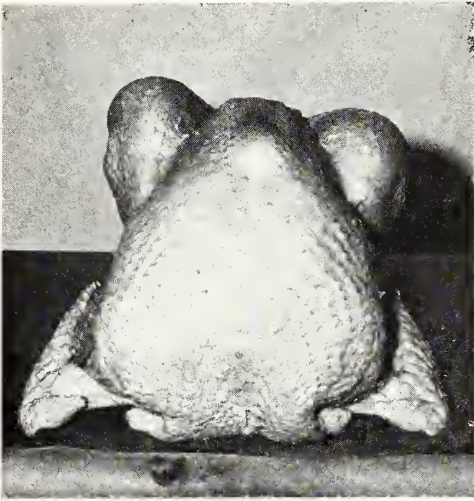
perienced with one breed, the combined results yielded a net profit. The two breeds (Broad Breasted Bronze and Beltsville Small Whites) were grown this year. Mortality was much higher in both breeds than for any previous year. Poults of poor quality, Newcastle disease, plus an unidentified disease resulted in high mortality of young poults. It was necessary to obtain replacement poults of both breeds, which resulted in such late hatched turkeys that the quality at market age was lower than for previous years. The necessity of replacing poults increased greatly the cost of poult "per turkey marketed"—to \$1.08 for Broad Breasted Bronze and \$3.28 for Beltsville Small Whites. The high poult cost cut the margin of income over feed cost and poult cost to \$2.16 per B. B. Bronze turkey and resulted in a loss of \$1.31 per B. S. White turkey. This is the first year that any group of turkeys failed to yield a net profit. For both breeds combined, the net income over poult and feed costs for this year was \$1.37 per turkey.

Consideration of the data presented in the tables in the Appendix seems to justify the following observations. The distinct difference in size of Broad Breasted Bronze and the Beltsville Small White breeds is well known. The figures in Table 1 (see Appendix) bear this out. Considerable variation in average size occurred from year to year for both breeds. This is not surprising considering the fact that different stock, rations, and methods of management were used and variable weather conditions experienced. Bronze toms averaged 64 per cent heavier than hens of the same breed at 28 weeks of age but only 51 per cent heavier when 24 weeks old. Similarly, Beltsville toms averaged 64 per cent heavier than Beltsville hens at 24 weeks of age and were 49 per cent heavier when 20 weeks old. It may be noted that on the average more than two-thirds of the mortality occurred during the first eight weeks of life, with most of it between day old and four weeks of age. The fact that practically 80 per cent of the poults started were grown to market age indicates that turkeys are not too difficult to grow.

Bronze turkeys consumed about 90 pounds of feed per turkey to market age, usually 28 weeks, while Beltsvilles averaged 67 pounds to market age—usually 24 weeks (Table 3). On the other hand the Bronze made better use of their feed than did the Whites, producing a pound of turkey on about one-half pound less feed (Bronze, 4.9 lbs.; B. S. Whites, 5.3 lbs.) The B. B. Bronze produced on the average a greater return over cost of poults and feed. The market outlet influences this markedly. If large toms move at a good price the advantage of the larger breed is greater. On the other hand if the demand is for smaller "family size" turkeys the B. S. Whites will be more desirable.

Summarized results of processed weights are given in Table 4 by breeds and by sexes for the different years. Similar but more detailed figures, including carcass, giblet, and neck weights, are presented in Tables 5 and 6. Dressed weight expressed as percentage of live weight (turkeys held approximately 12 hours without feed but with water avail-

able) averaged slightly over 92 per cent for B. B. Bronze and nearly 90 per cent for B. S. Whites. There was practically no difference in dress-



Ready-to-cook Beltsville Small White tom from one of the experiments at the North Louisiana Experiment Station.

ing percentage for males and females of the same breed. The larger breed yielded approximately 1.5 per cent higher percentage of eviscerated (total drawn or oven-dressed) weight (slightly more than 81 per cent as compared to 78.6 per cent for B. S. Whites). The giblets (liver, gizzard, heart) represent a slightly higher percentage of the total drawn weight for B. S. Whites than for Bronze turkeys and in both breeds the giblets weight is relatively greater for the females. Conversely, the weight of the neck is greater (actual and percentagewise) for toms than for hens. The carcass alone (excluding giblets and neck) averages about 3 per cent more, percentagewise, for Bronze than for Beltsville Whites, with little difference for the two sexes of the same breed. The hauling shrinkage (about 200 miles by truck) for Beltsville Small Whites averaged 3.5 to 4.0 per cent, with the toms losing slightly more than the hens. In Table 7 are given detailed weights of the liver, gizzard, and heart for a limited number of males and females of the Broad Breasted Bronze breed.

The feed consumption figures (mash, corn, and oats) by four-week periods are given in Table 8 for different years and management methods (ranged and confined) for Broad Breasted Bronze. Similar figures for Beltsville Small Whites are given in Table 9. These figures may serve as a guide to the feed requirements as the turkeys get older and larger. Attention is called to the greater consumption of grain, actual and percentagewise, as the turkeys approach maturity. Comparisons of the mash and total feed consumption of the two breeds are made in Table 10. When the Beltsville Small Whites were marketed at 24 weeks of age and the Broad Breasted Bronze at 28 weeks, the Beltsville Small Whites con-

sumed about two-thirds as much mash as the Bronze, whether grown in confinement or on range. In total feed consumption the Beltsville Small Whites consumed relatively less. When both breeds were carried to 28 weeks of age the Beltsville Small Whites consumed 82 per cent as much mash as the larger breed (both confined and ranged), while total feed consumption of the Whites was 68 per cent of that for the Bronze when confined and about 77 per cent as much when grown on range.

GENERAL COMMENTS AND RECOMMENDATIONS

Economic Factors in Turkey Production

Turkey production has expanded into big business with around 50-60 million turkeys raised in the U. S. each year. Louisiana is decidedly deficient in turkey production, about 5 pounds per capita. This means that around 750,000 to one million more turkeys are needed each year to meet the consumption demand in Louisiana.

Many factors enter into the economics of market turkey production to affect the success or failure of the business. The price of land, of buildings and equipment and of poults, mortality of the flock, the number of turkeys raised, the amount and cost of feed consumed, disease outbreaks, hours of labor involved, weight and condition of turkeys at time of marketing, market price (less costs of transportation and marketing) are among the factors determining a profit or loss.

Fixed investment is low for turkey production compared to other types of farming. Shultis and Newlon of California (1951) report the cost to be around \$2.00 to \$3.00 per bird. There is reason to believe that this often can be less in Louisiana because of lower costs of land, labor, and building supplies. The operating costs of raising market turkeys are high owing to the quantity of feed consumed, prices paid for feed, and cost of poults.

Some factors that weigh heavily in the success of turkey production are mentioned. The margin of profit requires correct decisions at every step of the process. Finances have to be adequate. Poults must be of good quality and be pullorum free. Good management and disease prevention and control are indispensable. Feed must be of the right kind and purchased wisely. The turkeys must be brought to the right degree of finish at the time the market is right and marketed advantageously. Experience and technical training on the part of the producer are desirable but are not indispensable. The willingness to learn and seek technical information is very important.

When and How to Obtain Poults

It was found that under Louisiana climatic conditions, 24 weeks usually was required to raise and finish Beltsville Small Whites and 28 weeks for the Broad Breasted Bronze. To meet the Thanksgiving market period, the Broad Breasted Bronze poults should be obtained around May 1 and Beltsville Whites around the 20th of May. However, with year-

round consumption of turkey increasing, especially for smaller birds, it is possible to start at other times and still find a market for the turkeys.

For smaller producers it is recommended that poults be purchased from a hatchery. However, it is possible to buy eggs and have them hatched by a local hatchery. Hatcheries specializing in turkey poults are in a better position to eliminate diseases, since they produce no chicks.

Sanitation and Disease Prevention

The sanitation program needs to begin before the poults arrive and be continued until all the turkeys have been marketed. Disease prevention is more satisfactory than treatment. The litter should be kept dry and clean by stirring and by adding litter occasionally. Wash the waterers daily and keep waterers and feeders on wire platforms. Watch the flock closely and remove immediately any poult that appears sick. Success depends on sanitation and disease prevention and not on medication. The use of pink pills or doping the water will not solve the disease problem, but good care, reasonable sanitation, and watchfulness will help prevent disease. If a disease outbreak does occur in the flock, get help immediately. Other producers, county agents or veterinarians may give assistance. Get a diagnosis as soon as possible. Louisiana has two state diagnostic laboratories, one located in Baton Rouge and one at Ruston.

Nutritional Diseases

Nutritional diseases are varied and are due to deficiencies in the rations. With the use of turkey rations prepared and recommended by one of the better feed manufacturers, it is unlikely that the producer will run into trouble. If the producer chooses to mix his own feed, he should become familiar with the requirements and know the feeds and supplements to use to meet the requirements of turkeys. The treatment for a nutritional disease is to correct the deficiency.

Mortality and Culling

Mortality is a very important factor. Because of heavy mortality in past years, it has been said that turkeys are hard to raise. This is not necessarily true. With good management, mortality can be held fairly low. In the Louisiana experiments mortality and culling ranged from a high of 52.6 per cent in 1951 (two breeds) to a low of 7.9 per cent in 1948. The entire seven-year average of mortality and culling was 20.2 per cent as compared with a 1944-50 average of 30 per cent mortality for the southern states and 19.8 per cent mortality for the United States as a whole. Turkeys consume a lot of feed, so one can see that heavy mortality at any time, and especially in the later part of the production period, can be costly. Two typical examples of this were experienced. One was the heavy mortality during the first two weeks in 1951. Another year dogs killed 30 turkeys when they were nearing market size. The loss is not only the amount invested in the turkeys and in the feed, but when turkeys die, profit that could have been derived from them is lost.

SUMMARY

Success in growing turkeys depends on many factors. Good pullorum free poults should be obtained and special attention given to sanitation, disease prevention and control, teaching the poults to eat and proper brooding. Feed a complete recommended turkey ration that meets the requirements for minerals, vitamins, and a high level of protein. Enheptin included in the ration when the turkeys are on range will help keep blackhead under control. Provide a good green range after the brooding period. Buy wisely and market wisely. Keep up with and follow technical information that has been proved to be worthwhile.

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APPENDIX

TABLE 1. Growth Rate for Different Years (Two Breeds)
(Average Weight in Pounds)

			Age in Weeks								
Year	Mgt.	Day Old	4	8	12	16	20	24	28	32	
Broad Breasted Bronze											
Males											
1945	(1) (2)	.13	1.1	4.1	7.7	11.9	16.4	20.9	25.8		
1946	(2)	.13	1.1	3.8	7.8	12.4	16.5	20.2	25.6		
1947	(1)	.12	.96	4.1	7.6	11.4	15.1	18.6	23.0	27.3	
1951	(5)	.12	.79	2.8	6.4	10.9	14.6	18.9	22.9		
Females											
1945	(1) (2)	.13	1.0	3.4	6.2	9.2	11.8	13.9	16.0		
1946	(2)	.12	.90	3.2	6.4	9.5	11.9	13.7	15.3		
1947	(1)	.12	—	3.3	6.0	8.7	11.0	12.3	14.1	15.5	
1951	(5)	.12	.75	2.4	5.3	8.4	10.4	12.2	13.8		
Beltsville Small Whites											
Males											
1947	(1) (3)	.12	.90	3.3	6.3	9.6	12.8	16.5			
1948	(1)	.12	.70	2.5	5.0	8.0	11.0	14.8	17.1		
1949	(4)	—	.79	2.6	5.2	8.1	11.3	13.3			
1950	(4)	—	.90	2.2	5.1	8.2	11.7	14.7	17.8		
1951	(5)	—	.66	2.3	5.4	8.4	12.0	14.5			
Females											
1947	(1) (3)	.12	.76	2.6	4.8	7.0	8.8	10.1			
1948	(1)	.11	.60	1.8	3.8	5.9	7.9	9.1	9.8		
1949	(4)	—	.78	2.2	4.2	6.2	7.7	8.7			
1950	(4)	—	.80	2.0	4.0	6.0	7.8	8.9	9.9		
1951	(5)	—	.61	1.9	4.1	6.1	7.3	8.2			

- (1) Some lots were grown in confinement. All lots were grown on range unless otherwise designated.
- (2) Diets varied—some with simple mash, others complex mash, and others 32% protein supplement. All had grain also.
- (3) All grown at Baton Rouge, in confinement.
- (4) Three different pastures used.
- (5) Turkeys late hatched, because necessary to replace original poults.

TABLE 2. Percentage Mortality and Culling of Turkeys Grown at Calhoun
For Seven Years, 1945-1951

Year	Breed	Day old to 4 Wks.	4-8 Wks.	8 Wks. to Market Age	Livability or Percentage Marketed of Those Started
1945	B. B. Bronze	7.5	4.0	6.4	85.7
1946	"	12.8	2.4	4.1	80.7
1947	"	6.8	0.0	18.3*	74.9
1947	Beltsville S. W.	2.9	5.0	5.8	86.3
1948	"	5.3	0.0	2.6	92.1
1949	"	4.0	2.9	5.6	87.5
1950	"	10.7	1.3	3.4	85.0
1951	"	65.8†	4.3	1.7	28.2
1951	B. B. Bronze	29.4†	2.2	4.3	64.0
Average for Seven Years‡		Day old 8-wks. of age	14.6	6.3	79.8

*Includes 30 killed by dogs (5.6%) at 16 weeks of age.

†This year 32 were weak hatched poults and 81 died during or before the second week. Hatchery replaced these poults.

‡A total of 1,711 poults started and 1,364 turkeys marketed (includes one group grown at Baton Rouge).

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TABLE 3. Margin of Income over Cost of Feed and of Poults and Feed Efficiency
(Summary of Results Seven Years at Calhoun, 1945-51)

Year	How Grown	Sex	Breed	Lbs. Feed Consumed	Cost of Feed	Lbs. Feed per Lb. Turkey	Income per Bird	Margin over Poults & Feed Cost (per Bird)
1945	Pasture	M & F	B. B. Bronze	105.4	4.15	5.5	6.90	2.00
1946	Pasture	M & F	"	91.7	4.54	4.5	7.04	1.75
1947	Confined	Females	"	80.7*	4.48	5.9	6.68	1.23
1947	Confined	Males	"	106.3*	5.93	4.7	10.36	3.46
1947	Pasture	M & F	"	75.8*	4.28	4.1	8.77	3.52
1951	Pasture	M & F	"	89.0	4.19	5.0	7.43	2.16
1948	Confined	Females	Beltsville S. W.	64.4†	3.42	6.2	4.87	.64
1948	Confined	Males	"	85.2†	4.50	5.0	8.48	3.16
1948	Pasture	M & F	"	62.9†	3.32	4.8	6.52	2.38
1949	Pasture	M & F	"	54.3	2.45	5.3	4.35	1.54
1950	Pasture	M & F	"	73.7†	3.48	5.4	5.56	1.20
1951	Pasture	M & F	"	60.6	2.92	5.6	4.89	1.31 (loss) ‡

*Not sold until 32 weeks of age.

†Not sold until 28 weeks of age.

‡Extremely high mortality caused year including both breeds was \$1.37 per turkey, that a net loss resulted. Net income for

TABLE 4. Summary of Processed Weights, by Breed, Year and Sex, for Seven Years

Year	How Grown	Age, (Weeks)	No. Dressed	Live Wt.	Chilled Dressed Wt. (lbs.)	Dressed Wt. as % of Live Wt.	Drawn (over: dr.) Wt. (lbs.)	Drawn Wt. as % of Live Wt.
Broad Breasted Bronze								
Males								
1945	Pasture	28	30	26.5	24.5	92.5	21.4	80.8
1945	Confined	28	20	25.0	23.2	92.8	20.2	80.8
1946	Pasture	28	30	27.1	25.1	91.3	22.3	82.5
1947	"	32	10	28.4	25.9	91.2	22.9	80.5
1947	Confined	32	10	27.3	25.1	91.8	22.0	80.4
1951	Pasture	28	10	22.8	20.6	90.1	18.2	80.0
110								
Females								
1945	Pasture	28	30	15.4	14.2	92.2	12.4	80.5
1945	Confined	28	20	16.6	15.4	92.8	13.6	81.9
1946	Pasture	28	30	15.9	14.8	93.3	13.4	84.1
1947	"	32	10	15.9	14.7	92.5	12.5	79.0
1947	Confined	32	10	15.9	14.6	91.8	12.8	80.4
1951	Pasture	28	10	13.4	12.0	89.5	10.6	79.0
110								
Beltsville Small Whites								
Males								
1947	Confined*	24	31	16.1	14.6	90.3	12.8	79.2
1948	"	28	10	16.9	15.2	90.2	13.6	80.3
1948	Pasture	28	20	16.8	15.3	90.7	13.4	79.8
1949	"	21	15	13.2	11.8	89.6	10.2	76.8
1949	"	24	15	14.5	13.1	90.5	11.6	79.9
1950	Lot 1 "	28	10	16.8	14.9	88.9	13.2	78.6
1950	Lot 2 "	28	10	18.1	16.2	89.8	14.5	79.9
1950	Lot 3 "	28	10	17.8	16.1	90.4	14.3	80.4
1951	"	24	10	13.8	12.2	88.0	10.5	75.8
1951	"	24	10	13.8	12.2	88.0	10.5	75.8
131								
Females								
1947	Confined*	24	12	10.7	9.6	90.3	8.4	78.6
1948	"	28	10	9.9	9.0	90.8	8.0	80.3
1948	Pasture	28	20	9.9	8.9	90.0	7.9	79.3
1949	"	21	15	8.2	7.2	87.7	6.2	76.2
1949	"	24	15	9.3	8.5	91.2	7.4	79.0
1950	Lot 1 "	28	10	9.9	9.0	90.1	7.9	79.7
1950	Lot 2 "	28	10	9.7	8.8	90.4	7.8	80.3
1950	Lot 3 "	28	10	9.9	8.8	88.7	7.7	77.8
1951	"	24	10	7.9	7.0	88.2	6.1	77.2
112								

*Grown at the Main Station at Baton Rouge. All others at the Calhoun Station.

TABLE 5. Hauling Shrinkage, Weights of Carcass and of Giblets of Small Whites, by Lots and Sex

Year	Lot	Age	No. Dr.	Live Weights (lb)		% Haul.	Ch. Dres. (wt.)		Drawn (oven dressed) Weights				Tot. Drawn Wt. lbs.	% of Live Wt.			
				at Cal.	at B.R.		Shrink	lbs.	as % of B. R. Liv. wt.	Carcass Wt.		Giblets			Neck		
										lbs.	% of Liv. Wt.	lbs.			% of Liv. Wt.	lbs.	% of Liv. Wt.
Males																	
1947 Conf.*		24	31	—	16.1	—	14.6	90.3†	11.7	72.4	.55	3.4	.53	3.3	12.8†	79.4	
1948 Range		28	20	17.4	16.8	3.4	15.3	91.1	12.3	73.2	.56	3.3	.55	3.3	13.4	79.8	
1948 Conf.		28	10	17.3	16.9	2.3	15.2	90.1	12.3	72.2	.56	3.3	.64	3.8	13.6	80.3	
1949	1	21	5	13.6	12.9	5.1	11.5	89.3	9.0	69.8	.53	4.1	.37	2.9	9.9	76.7	
	2	21	5	14.2	13.6	4.2	12.4	91.0	9.7	71.3	.51	3.8	.40	2.9	10.6	78.0	
	3	21	5	13.7	13.1	4.4	11.6	88.5	8.9	68.3	.55	4.2	.41	3.1	9.9	75.6	
1949	1	24	5	14.6	14.5	1.1*	13.1	89.9	10.4	71.9	.62	4.3	.44	3.6	11.5	79.2	
	2	24	5	14.4	14.8	4.4*	13.4	90.8	10.8	73.2	.58	3.9	.45	3.0	11.8	80.1	
	3	24	5	14.4	14.2	2.2*	12.9	90.9	10.4	73.3	.56	3.9	.46	3.2	11.5	80.5	
1950	1	28	10	17.5	16.8	4.0	14.9	88.9	11.9	70.8	.64	3.8	.62	3.7	13.2	78.6	
	2	28	10	18.6	18.1	2.7	16.2	89.8	13.2	72.9	.64	3.5	.63	3.9	14.5	79.9	
	3	28	10	18.8	17.8	5.3	16.1	90.4	13.1	73.6	.61	3.4	.62	3.9	14.8	80.4	
1951		24	10	14.7	13.8	6.1	12.2	88.0	9.3	67.4	.57	4.1	.57	4.1	10.5	75.8	
Av. of all samples			131			4.2		89.9		71.6		3.8		3.4		78.8	
Females																	
1947 Conf.		24	12	—	10.7	—	9.6	90.3	7.7	72.0	.43	4.0	.27	2.5	8.4	78.6	
1948 Range		28	20	10.2	9.9	2.9	8.9	90.0	7.2	72.7	.38	3.8	.28	2.8	7.9	79.3	
1948 Conf.		28	10	10.1	9.9	2.0	9.0	90.8	7.2	72.7	.41	4.1	.29	2.9	8.0	80.3	
1949	1	21	5	8.6	8.3	3.5	7.2	87.4	5.6	68.0	.40	4.8	.26	3.1	6.3	76.1	
	2	21	5	8.4	8.1	3.6	7.1	87.7	5.6	69.1	.34	4.2	.22	2.7	6.2	76.3	
	3	21	5	8.4	8.1	3.6	7.1	87.7	5.6	69.1	.37	4.6	.24	3.0	6.2	76.3	
1949	1	24	5	9.7	9.8	0.1**	9.0	91.5	7.0	70.7	.44	4.5	.31	3.2	7.7	78.4	
	2	24	5	9.4	9.0	4.3**	8.2	90.9	6.6	72.7	.36	4.0	.30	3.3	7.2	80.1	
	3	24	5	9.4	9.1	3.2**	8.3	91.2	6.4	70.4	.43	4.7	.29	3.2	7.2	78.4	
1950	1	28	10	10.4	9.9	4.8	9.0	90.1	7.2	72.7	.41	4.1	.31	3.4	7.9	79.7	
	2	28	10	10.1	9.7	4.0	8.8	90.4	7.1	73.2	.42	4.3	.31	3.2	7.8	80.3	
	3	28	10	10.2	9.9	2.9	8.8	88.7	7.0	70.7	.42	4.2	.31	3.1	7.7	77.8	
1951		24	10	8.3	7.9	4.8	7.0	88.2	5.4	68.4	.37	4.7	.30	3.8	6.1	77.2	
Av. of all samples			112		3.	3.6		89.7		71.0		4.3		3.1		78.4	

*Refers to management (grown on range or in confinement) and type of ration (a complex mash with grain, simple mash with grain, or 32% protein supplement with grain ad libitum).

†Apparent discrepancies may result from using total (not average) weights and rounding off figures.

‡Rounding figures may cause slight differences in totals and the several parts.

**Live weights at Calhoun and Baton Rouge taken 5 days apart for groups indicated. These lots therefore not included in averages. In all other cases Calhoun and Baton Rouge weights were made on consecutive days.

TABLE 6. Weights of Carcass and of Giblets of Broad Breasted Bronze. By Lots and Sex

Year	Lot	Age	No. Dr.	Live Weights (lb)		% Haul Shrink.	Ch. Dres. (wt.) lbs.	Ch. Dres. (wt.) as % of B. R. Liv. wt.		Drawn (oven dressed)				Weights		Tot. lbs.	Drawn Wt.	
				at Cal.	at B.R.			lbs.	% of B. R. Liv. wt.	Carcass lbs.	Wt. of Liv. Wt.	Giblets lbs.	% of Liv. Wt.	Neck lbs.	% of Li. Wt.		lbs.	% of Live Wt.
Males																		
1945	Ra. Co. 1*	28	10		27.3		25.2	92.2†	20.0	73.3	1.0	3.7	1.0	3.7	22.1‡	80.9		
	Ra. Si. 2	28	10		26.6		24.7	92.9	19.7	74.1	1.0	3.8	0.8	3.0	21.5	80.8		
	Ra. Sup. 3	28	10		25.7		23.6	91.7	18.9	73.5	0.9	3.5	0.9	3.5	20.7	80.6		
	Conf. Co. 4	28	10		25.7		23.8	92.6	18.9	73.5	0.9	3.5	0.9	3.5	20.7	81.4		
	Conf. Sup. 5	28	10		24.3		22.5	92.7	17.7	72.8	0.9	3.7	0.9	3.7	19.6	80.5		
1946	Ra. Co. 1	28	10		26.6		24.7	92.9	20.1	75.6	1.0	3.8	0.9	3.4	22.0	82.6		
	Ra. Si. 2	28	10		27.2		25.5	92.9	20.4	75.0	1.1	4.0	1.0	4.0	22.4	82.0		
1947	Ra. Sup. 3	28	10		27.2		25.2	92.6	20.5	75.4	1.1	4.0	0.9	3.3	22.5	83.1		
	Range	32	10		28.4		25.9	91.2	21.0	73.9	0.9	3.2	1.0	3.5	22.9	80.5		
1951	Conf.	32	10		27.3		25.1	91.8	20.2	74.0	0.9	3.3	0.9	3.3	22.0	80.4		
		28	10	24.5	22.8	6.9	20.6	90.1	16.6	72.8	0.8	3.5	0.8	3.5	18.2	80.0		
			110					92.1		74.0		3.6		3.5		81.2		
Females																		
1945	Ra. Co. 1	28	10		15.6		14.4	92.4	11.6	74.4	0.5	3.2	0.4	2.6	12.6	80.5		
	Ra. Si. 2	28	10		15.1		13.9	92.2	11.4	75.5	0.5	3.3	0.4	2.6	12.2	81.1		
	Ra. Sup. 3	28	10		15.6		14.3	91.6	11.5	73.7	0.6	3.8	0.4	2.6	12.5	79.9		
	Conf. Co. 4	28	10		16.4		15.3	93.7	12.3	75.0	0.6	3.7	0.4	2.4	13.4	81.8		
	Conf. Sup. 5	28	10		16.7		15.6	93.5	12.6	75.4	0.6	3.6	0.4	2.4	13.7	81.8		
1946	Ra. Co. 1	28	10		16.2		15.1	93.0	12.2	75.3	0.9	5.6	0.5	3.1	13.6	84.3		
	Ra. Si. 2	28	10		16.1		15.0	92.7	12.2	75.8	0.9	5.6	0.5	3.1	13.5	83.6		
1947	Ra. Sup. 3	28	10		15.4		14.4	92.9	11.7	76.0	0.9	5.2	0.5	3.2	13.0	84.6		
	Range	32	10		15.9		14.7	92.5	11.6	73.0	0.5	3.1	0.4	2.5	12.5	79.0		
	Conf.	32	10	14.0	13.4	4.3	12.0	80.5	9.6	71.6	0.5	3.7	0.5	3.7	10.6	79.0		
			100					92.3		74.6		4.0		2.8		81.5		

*Refers to management (grown on range, Ra., or in confinement, Conf.) and type of ration (a complex mash with grain, Co., simple mash with grain, Si., or 32% protein supplement with grain ad libitum, Sup.).

†Apparent discrepancies may result from using total (not average) weights and rounding off figures.

‡Rounding figures may cause slight differences in totals and the several parts.

TABLE 7. Weight of Liver, Gizzard, Heart, Neck in Relation to Carcass Weight in Broad Breasted Bronze

Lot	No.	Tur.	Sex	Liv. Wt.	Chil.		Dr.		Carc. Wt.		Neck Wt.		Liver Wt.		Gizzard Wt.		Heart Wt.		Tot. Evis. Wt.	
					lbs.	% of Li. Wt.	lbs.	% of Li. Wt.	lbs.	% of Li. Wt.	lbs.	% of Li. Wt.	lbs.	% Li. Wt.	lbs.	% Li. Wt.	lbs.	% Li. Wt.	lbs.	% Live Wt.
1	10		M	26.6	24.7	92.9*	0.92	75.7	20.1	75.7	0.92	3.5*	.34	1.3*	.44	1.7*	.22	0.8*	22.0	82.6
2	10		"	27.2	25.2	92.9	0.97	75.0	20.4	75.0	0.97	3.6	.39	1.4	.53	1.9	.22	0.9	22.5	81.9
3	10		"	27.2	25.2	92.6	0.98	75.2	20.5	75.2	0.98	3.6	.41	1.5	.48	1.8	.22	0.8	22.6	83.1
Av. all lots 30				27.0	25.1	92.8	0.96	75.3	20.3	75.3	0.96	3.6	.38	1.4	.48	1.8	.22	0.8	22.3	82.6
Av. all lots 30	10		F.	16.2	15.1	93.0	0.50	75.3	12.2	75.3	0.50	3.1	.32	2.0	.43	2.6	.20	1.2	13.6	84.3
	10		"	16.1	15.0	92.7	0.47	75.3	12.2	75.3	0.47	2.9	.29	1.8	.43	2.7	.14	0.9	13.5	83.6
	10		"	15.4	14.4	93.9	0.48	76.1	11.7	76.1	0.48	3.1	.27	1.8	.41	2.7	.15	1.1	13.0	84.6
	Av. all lots 30			15.9	14.8	93.2	0.48	75.6	12.0	75.6	0.48	3.0	.29	1.9	.42	2.7	.17	1.1	13.4	84.1

*Percentages based on totals, not averages.

TABLE 8. Feed Consumed per Turkey, by Four-Week Periods, Broad Breasted Bronze

Year and Lot	Kind of Feed	Age in Weeks								Da. ol. to 28 wks.	Da. ol. to 32 wks.
		0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32		
1945											
Confined (two lots combined) (both sexes)	Mash	2.10*	6.46*	16.6	21.2	17.6	21.2	13.0		98.2	
	Corn		.09	.40	2.2	4.2	7.0	5.2		19.1	
	Oats		.15	.44	1.1	5.4	5.1	7.4		19.6	
	Tot. Fe.	2.10	6.7	17.4	24.5	27.2	33.3	25.6		136.8	
Range (3 lots combined) (both sexes)	Mash†	2.10	6.46	11.8	15.9	11.5	11.6	9.3		68.7	
	Corn		.09	.46	1.2	3.6	5.7	9.9		20.9	
	Oats		.15	.23	.7	4.2	4.3	6.1		15.7	
	Tot. Fe.	2.10	6.7	12.5	17.8	19.3	21.6	25.3		105.3	
1946											
Range (3 lots combined) (both sexes)	Mash	1.9*	4.0*	11.3	12.7	11.5	12.3	10.0		63.7	
	Corn		0.6	1.0	1.7	4.1	7.5	8.9		23.8	
	Oats			0.1	.3	‡		1.2		1.6	
	Tot. Fe.	1.9	4.6	12.4	14.7	15.6	19.8	20.1		89.1	
1947											
Confined (males)	Mash	2.1*	5.5*	13.0	12.4	12.2	21.4	15.3	17.0	81.9	98.9
	Corn		.2	1.0	2.4	3.5	.6	4.2	4.9	11.9	16.8
	Oats			.8	2.5	3.2	2.3	3.8	3.4	12.6	16.0
	Tot. Fe.	2.1	5.7	14.8	17.3	18.9	24.3	23.3	25.3	106.4	131.7
Confined (females)	Mash	2.1	5.5	9.0	11.4	12.2	8.0	10.1	5.8	58.3	64.1
	Corn		.2	1.2	2.7	3.3	1.9	1.9	7.1	11.2	18.3
	Oats			0.7	2.8	3.1	2.5	2.2	4.3	11.3	15.6
	Tot. Fe.	2.1	5.7	10.9	16.9	18.6	12.4	14.2	17.2	80.8	98.0
Range (both sexes)	Mash	2.1	5.5	9.3	8.8	11.7	10.5	9.7	10.7	57.6	68.3
	Corn		.2	0.6	2.9	2.1	2.3	5.5	7.4	13.6	21.0
	Oats			0.2	1.1	1.0	0.9	1.4		4.6	4.6
	Tot. Fe.	2.1	5.7	10.1	12.8	14.8	13.7	16.6	18.1	75.8	93.9
1951											
Range (2 lots combined) (both sexes)	Mash	1.6*	7.4*	9.9	15.9	15.5	8.6	7.7		66.6	
	Corn					2.2	5.1	5.9		13.2	
	Oats					1.7	2.2	2.8		6.7	
	Tot. Fe.	1.6	7.4	9.9	15.9	19.4	15.9	16.4		86.5	

*All poults were started in two brooder houses. At eight weeks of age the poults were re-distributed into five lots in 1945, into 3 lots in 1946, into 3 lots in 1947, and into 2 lots in 1951.

†One lot fed 32% protein supplement.

‡Oats not available from 16 to 24 weeks of age.

TABLE 9. Feed Consumed per Turkey, by Four-Week Periods, Beltsville Small Whites

Year and Lot	Kind of Feed	Age in Weeks							Totl. Da. old	Totl. Da. old
		0-4	4-8	8-12	12-16	16-20	20-24	24-28	to 24 wk.	to 28 wk.
1947										
Confined* (both sexes)	Mash†	1.5	5.0	7.7	8.5	10.1	8.2		41.0	
	Grain			0.5	1.2	3.8	9.1		14.6	
	Tot. Feed	1.5	5.0	8.2	9.7	13.9	17.3		55.6	
1948										
Confined males	Mash	1.7‡	5.0	8.3	15.3	15.5	19.7	11.8	65.5	77.3
	Grain	—		0.4	0.5	0.4	2.4	4.7	3.7	8.4
	Oats	—		0.4	0.1	**			0.5	0.5
	Tot. Fe.	1.7	5.0	9.1	15.9	15.9	22.1	16.5	69.7	86.2
Confined Females	Mash	1.7‡	5.0‡	9.9	10.9	8.1	9.3	8.5	44.9	53.4
	Grain			0.2	0.9	1.3	4.4	2.7		7.1
	Oats			0.3	0.2	**			0.5	0.5
	Tot. Fe.	1.7	5.0	10.4	12.0	8.4	10.6	12.9	48.1	61.0
Range (both sexes)	Mash	1.7‡	5.0‡	7.7	9.2	11.7	8.6	8.4	43.9	52.3
	Grain			0.1	0.1	0.6	3.6	5.0	4.4	9.4
	Oats			0.1	0.2	**			0.3	0.3
	Tot. Fe.	1.7	5.0	7.9	9.5	12.3	12.2	13.4	48.6	62.0
1949										
Range (3 lots combined) (both sexes)	Mash	1.8‡	5.4‡	10.7	8.1	6.2	3.7		35.9	
	Grain				1.3	2.8	3.3		7.4	
	Oats				2.8	3.8	4.5		11.1	
	Tot. Fe.	1.8	5.4	10.7	12.2	12.8	11.5		54.4	
1950										
Range (3 lots combined) (both sexes)	Mash	2.0‡	6.1‡	8.5	9.1	10.0	8.8	9.1	44.5	53.6
	Grain			0.3	1.3	1.6	5.6	7.7	8.8	16.5
	Oats			0.3	1.3	2.5	0.8	**	4.9	4.9
	Tot. Fe.	2.0	6.1	9.1	11.7	14.1	15.2	16.8	58.2	75.0
1951										
Range (1 lot) (both sexes)	Mash	2.1	9.6	11.3	10.7	8.3	3.3		45.3	
	Grain				0.5	4.1	4.8		9.4	
	Tot. Fe.	2.1	9.6	11.3	11.2	12.4	8.1††		54.7††	

*These turkeys grown in confinement at Baton Rouge.

†Mash fed in pellet form.

‡All poults were started in two brooder houses. At eight weeks of age they were re-distributed as indicated.

**Oats not available after period indicated.

††Age 23.5 weeks (not 24 weeks) of age when marketed.

TABLE 10. Comparison of Feed Consumption of Two Breeds of Turkeys
(Feed Consumption of Beltsville Small Whites as Percentage of that of Broad Breasted Bronze.
Beltsville S. Whites to 24 weeks of age; B. B. Bronze to 28 weeks age*)

How Grown	No. of Groups	Total Feed	Mash
Confined	3 each breed	53.6%	63.6%
Range	4 each breed	60.5%	66.1%
Both Breeds 28 weeks of age			
	3—B.B.B.		
Confined	2—B. S. Wh.	68.3%	82.4%
	4—B.B.B.		
Range	2—B. S. Wh.	76.8%	82.6%

* The usual market age of these breeds.

Nutritive Values of Native Plants On Forest Range in Central Louisiana

By

ROBERT S. CAMPBELL, E. A. EPPS, JR.,
C. C. MORELAND, J. L. FARR, AND FRANCES BONNER



*Cattle do well on Louisiana forest ranges in spring and early summer,
but in fall and winter they need supplemental feed.*

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

In Cooperation With
Southern Forest Experiment Station
Forest Service, U. S. Department of Agriculture

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Nutritive Values of Native Plants on Forest Range in Central Louisiana¹

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The generally low productivity of cattle on forest ranges in Louisiana and elsewhere in the South is common knowledge. Small calf crops, low weights, and high death losses all reflect this poor productivity. The causes usually include poor breeding and low grade of livestock, failure to control diseases and parasites, and inadequate nutrition. A great deal of research has been done on animal breeding and health, and on the use of improved pastures to raise the level of nutrition. It is only in very recent years, however, that attention has been turned to the forage values of the forest range itself (2).³

This bulletin is the first publication of detailed chemical analyses of range forage plants in Louisiana. It evaluates the important range forage species at different stages of growth; considers the effects of such factors as timber type, burning, grazing, and fertilizing on nutrient content; points out the deficiencies in actual cattle diet at various times of the year; and suggests ways of meeting these deficiencies.

Methods

The forage samples were collected over the period 1944 through 1949. They were taken mainly from an experimental forest range in Grant Parish, in central Louisiana. Species samples were gathered at various stages of growth from marked areas. Composite cattle-diet samples were collected to represent actual cattle grazing at monthly periods. Composite grass samples to show the influence of timber type, burning, and grazing were obtained from marked areas in a special study in 1945 and 1946.

All samples were air-dried and sent to the Feed and Fertilizer Laboratory of Louisiana Agricultural Experiment Station, where the chemical

¹Investigations were conducted cooperatively by the Forest Service, U. S. Dept. of Agriculture, and the Louisiana Agricultural Experiment Station.

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³Italic numbers in parentheses refer to Literature Cited, p. 19.

analyses were made according to methods of the Association of Official Agricultural Chemists (1). All together, over 300 samples were taken; some 200 were analyzed for moisture, crude protein, ether extract, nitrogen-free extract (mainly starch), crude fiber, total ash, calcium, and phosphorus. For the remaining samples, only moisture, crude protein, total ash, and calcium and phosphorus were determined.

Total moisture and free moisture are here expressed in terms of the green weight of the forage sample, bound moisture in percent of air-dry weight, and nutrient contents in percent of oven-dry or moisture-free weight.

Nine percent crude protein in the cattle diet is ordinarily considered adequate for maintaining breeding herds. This standard was used as a guide to the approximate nutritive value of individual species and of composite grass samples under various forest conditions.

The 9-percent criterion assumes that digestibility of the forage remains the same throughout the year. There are indications, however, that digestibility of green roughages decreases as the growing season progresses. For this reason, percentage estimates were made of the digestible protein and total digestible nutrients in composite cattle diet samples. Diet deficiencies and needed supplemental protein and energy feeds were then computed by comparing these estimates with nutrition standards derived from recommendations of the National Research Council (7).

The Council's recommendations for beef cattle are calculated for large animals—for example, pregnant cows expected to weigh not less than 1,050 pounds before calving. Cows on southern forest range commonly weigh only 650 to 700 pounds at calving time, but with adequate nutrition they should weigh about 800 pounds or more. Adaptation of the Council's nutrient allowances to southern range cattle suggests the following approximate requirements for wintering pregnant beef cows (weighing 700 pounds in the fall) to attain at least 0.5 pound gain per head per day:

Daily feed per animal, pounds	
Air-dry basis	18.0
Moisture-free basis	16.5
Digestible nutrients (moisture-free)	
Percent in forage	55.0
Daily per animal, pounds	9.0
Digestible protein (moisture-free)	
percent in forage	5.0
Daily per animal, pounds	.8
Calcium (moisture-free)	
percent in forage	.20
Phosphorus (moisture-free)	
Percent in forage	.18

The nutrient requirements for cows that are nursing calves, and for normal growth of heifers and steers, are higher than these.

Protein and Minerals in Major Range Species

Table 1 shows the crude protein, calcium, and phosphorus of the principal species grazed by cattle in central Louisiana. Grazing observations on many of these species are summarized by Langdon, Bomhard, and Cassady (8).

The values in the table are averages, except where only one analysis was made. There was, of course, considerable variation: For example, the full-leaf stage of pinehill bluestem had an average crude protein content of 5.99 percent, the lowest of the 11 values being 4.65 percent and the highest being 7.90 percent. The important point is, however, that without exception the bluestem grasses contained adequate crude protein (9 percent or more) only in the young-leaf stage, which lasts but for a few weeks in spring. These bluestem grasses made up 63 percent of the average yearlong diet of cattle on the study range (2).

A few of the other grasses, such as green silkyscale, carpet grass, Dallis grass, and the early growing panicums, provided adequate crude protein in full-leaf or mature green stages or both.

Eight broadleaved herbs (forbs or weeds) were collected at the stage in which they were being grazed by cattle. While all of them provided adequate crude protein, they were grazed only for short periods.

Browse plants with green leaves had good protein content, but were only nibbled by cattle in winter.

Calcium was adequate or nearly so in all of the samples analyzed. Grasses had their highest phosphorus content in the young-leaf stage, but even that was insufficient. Various of the grasslike plants, forbs, and browse had adequate phosphorus.

Grazing, Fire, and Other Factors Affecting Protein and Mineral Content

The crude protein and phosphorus content of the forage is highest when the plants are in the young-leaf stage, ordinarily in early spring. Several additional factors, such as grazing, burning, and soil fertility, also affect protein and mineral content of forage.

Grazing or frequent harvesting is much more important in maintaining high protein content of forage than is generally realized. Grazing or harvesting removes the accumulated growth and stimulates new young growth that is high in protein.

Table 1. Crude protein, calcium, and phosphorus content (moisture-free basis) of forage plants at different stages of growth. Central Louisiana, 1944-49

Species	Stage of growth	Samples	Crude protein	Calcium	Phos- phorus
		Number	Percent		
G R A S S E S					
<i>Andropogon divergens</i> pinehill bluestem	young leaf	3	10.33	0.26	0.15
	full leaf	11	5.99	.30	.10
	mature (green)	4	4.98	.29	.06
	winter rough	2	3.15	.24	.05
<i>A. subternuifolius</i> fineleaf bluestem	full leaf	1	6.73	.24	.07
<i>A. tener</i> slender bluestem	young leaf	3	10.83	.30	.14
	full leaf	3	6.88	.25	.09
	mature (green)	1	3.48	.20	.04
	winter rough	1	2.80	.24	.04
<i>A. ternarius</i> paintbrush bluestem	full leaf	1	6.05	.39	.11
<i>A. virginicus</i> yellowsedge bluestem	winter rough	1	4.85	.20	.05
<i>Anthracnanthe villosa</i> green silkscale	full leaf	1	8.89	.20	.09
<i>Axonopus affinis</i> carpet grass	young leaf	2	13.05	.26	.14
	full leaf	3	10.72	.27	.11
<i>Muhlenbergia expansa</i> cutover muhly	winter rough	1	2.83	.23	.02
<i>Panicum angustifolium</i> narrowleaf panicum	mature (green)	1	6.77	.21	.07
<i>P. lanuginosum</i> woolly panicum	young leaf	1	16.33	.14	.15
	full leaf	2	12.36	.24	.14
	mature (green)	1	8.68	.35	.10
<i>P. sphaerocarpon</i> roundseed panicum	young leaf	1	13.38	.26	.17
	mature (green)	2	7.24	.30	.10
<i>P. virgatum</i> switchgrass	mature (green)	1	6.63	.25	.11
<i>Paspalum dilatatum</i> Dallis grass	mature (green)	1	8.05	.28	.18
<i>P. floridanum</i> Florida paspalum	full leaf	2	6.58	.28	.09
<i>P. plicatulum</i> brownseed paspalum	full leaf	1	7.47	.37	.13
<i>Sporobolus junceus</i> pineywoods dropseed	young leaf	2	11.41	.21	.12
	full leaf	2	6.64	.20	.06
	mature (green)	1	4.02	.29	.17

Table 1. (Continued)

Species	Stage of growth	Samples	Crude protein	Calcium	Phos- phorus
		Number	Percent		
G R A S S L I K E		P L A N T S			
<i>Juncus</i> sp.					
rush	young leaf	1	16.63	.33	.22
<i>Rhynchospora globularis</i>					
pinchill beakrush	young leaf	2	13.92	.28	.15
	full leaf	1	7.92	.28	.10
	winter leaf, green	2	6.90	.24	.08
F O R B S		(W E E D S)			
<i>Chrysopsis graminifolia</i>					
grassleaf goldaster	full leaf	1	9.78	.92	.18
<i>Desmodium ciliare</i>					
littleleaf tickclover	full leaf	2	10.42	1.05	.14
<i>Helianthus angustifolius</i>					
swamp sunflower	full leaf	2	10.56	1.19	.14
<i>Iva ciliata</i>					
seacoast sumpweed	early leaf	1	14.90	(¹)	(¹)
<i>Lepedeza striata</i>					
common lespedeza	full leaf	1	15.83	1.14	.20
<i>Pteridium aquilinum</i>					
southern bracken	early leaf	1	16.65	.29	.28
<i>Rudbeckia alismaefolia</i>					
plantainleaf coneflower	early leaf	1	16.38	1.41	.22
<i>Trifolium procumbens</i>					
hop clover	full leaf	1	22.24	1.11	.40
B R O W S E					
<i>Myrica cerifera</i>					
southern waxmyrtle	winter leaves and twigs	3	10.01	.96	.08
<i>Pinus echinata</i>					
shortleaf pine	winter needles, green	1	9.45	.25	.21
<i>P. palustris</i>					
longleaf pine	winter needles, green	3	7.39	.47	.14
<i>P. taeda</i>					
loblolly pine	winter needles, green	1	8.69	.20	.27
<i>Rhus copallina</i>					
shining sumac	young leaf	1	16.91	.31	.27
	winter twigs	2	4.13	.40	.08
<i>Vaccinium elliotii</i>					
Elliott blueberry	winter twigs	3	4.09	.46	.04

¹Not determined.

In a study made in 1947 at the Alexandria Research Center of the Southern Forest Experiment Station, a series of plots was protected from grazing. Every two weeks, six previously unclipped plots were harvested and the grass analyzed. Crude protein was 6.5 to 7.2 percent from April to May 15, but dropped below 6 percent for the rest of the summer and fall (Fig. 1). Each set of plots was clipped again 2 weeks after it was first harvested. The new fresh growth produced during these 14 days contained from 10.9 to 8.6 percent protein throughout the summer and early fall.

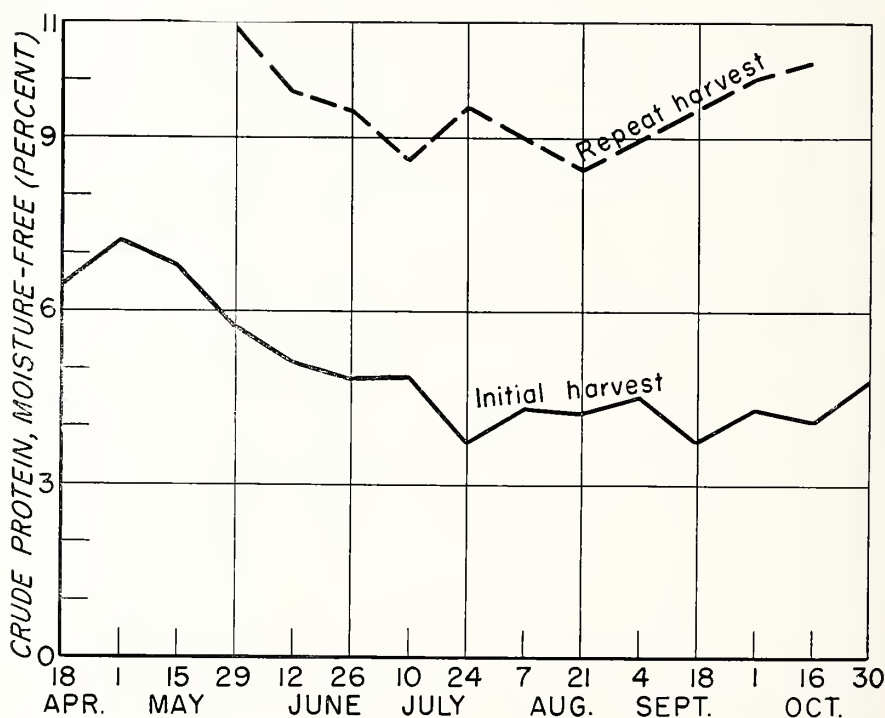


Figure 1. Crude protein content of herbage from plots harvested initially on dates shown, and again two weeks later.

Cassady (5), continuing this same study over a 3-year period, found that crude protein of grass on plots harvested every 4 weeks remained between 9 and 10 percent throughout the growing season. In contrast, crude protein in grass from previously unharvested plots declined from 9.5 percent in spring to 4.5 percent in late summer.

Although frequent close harvesting maintains high protein in the grass, total production is greatly reduced. Cassady (5) found that repeated harvesting at 2-week and 4-week intervals reduced grass production 41 percent and 33 percent, respectively, below undisturbed production. Much of the grass was killed, and this damaging effect appeared to last for

several seasons afterward, even under complete protection from grazing. Cassady concluded that relatively intensive grazing in spring and early summer may lengthen the cattle gaining season without drastically reducing forage production.

Burning, by removing accumulated old growth and stimulating succulent new growth high in crude protein and phosphorus, seems to have much the same effect on grass as close grazing. For individual species over a period of years, the average crude protein content of the young-leaf stage is significantly higher on recently burned areas than on unburned. This is illustrated by Table 2. The differences in protein content between burned and unburned range for the full-leaf and mature green stages are too small to be significant.

Table 2. Crude protein (moisture-free) in pinehill bluestem from burned and unburned range

Stage	Protein	
	Unburned range	Burned range
	Percent	
Young leaf	9.04	12.92
Full leaf	5.88	6.08
Mature (green)	5.18	5.29

Basis: 16 samples taken in 1944-49.

Similar relationships were found for a number of other grass species. Thus the effects of burning on nutrient content of the forage are quite temporary, and may be more than offset by the damage done to both timber and forage by injudicious burning or wildfire. In fact, there are indications that repeated burning may reduce grass production 40 percent or more (4).

For mixed grass samples the differences in protein content between burned and unburned areas were neither great nor consistent. Data for 3 years are shown in Table 3. The greatest difference between burned and unburned range was in spring (March-May), when most grasses are in the young-leaf stage. Differences at other seasons were too small and inconsistent to be statistically significant. Differences between seasons

Table 3. Crude protein (moisture-free) in composite grass samples on burned and unburned range, central Louisiana, 1944-1946

Season	Burned ¹				Unburned			
	1944	1945	1946	Average	1944	1945	1946	Average
	Percent							
Spring	12.3	12.2	7.1	10.5	7.5	12.4	6.1	8.7
Summer	6.3	6.3	5.1	5.9	5.0	6.0	5.5	5.5
Fall	8.6	5.3	5.3	6.4	5.3	4.9	4.7	5.0
Winter	3.1	5.5	5.8	4.8	4.9	4.2	4.4	4.5

¹Burns were made each year, in January, February, or March.

were highly significant, but differences between years were too variable for significance.

Two factors account for the higher nutritive value of forage following close harvesting, grazing, or burning:

1. The new growth that is stimulated contains more protein and phosphorus.

2. The grazing animal can take relatively pure new growth, unmixed with older grass of lower nutritive value.

It is commonly thought that the grass in a pine or hardwood forest does not have as high a nutritive value as that on open or untimbered range. To test this idea, forage samples of bluestem grasses were collected for chemical analysis periodically throughout 1945 in the open grass, longleaf pine, and scrub oak types (2). Average protein values in March were about 15 percent, but the content for all three types dropped below 5 percent by November. The differences in nutritive value of forage in these three forest types were inconsistent and are not important in animal nutrition.

It has been found that forest range grasses of east Texas have higher contents of crude protein, calcium, and phosphorus in the young-growth stage when they grow on soils high in nitrogen, calcium, and phosphorus (6). Tests with complete fertilizers (300 pounds per acre of 4-12-8, plus lime) were started in central Louisiana in 1946 to determine whether forage high in nutrients can be grown and saved on the stem for use during summer and fall. On ungrazed plots the forage production was increased 35 percent by fertilization, but the nutrient content was disappointingly low (10). Table 4 shows that crude protein was slightly higher in spring on the fertilized plots, but dropped to below-maintenance levels for cattle in summer and fall. Calcium was adequate on both fertilized and unfertilized plots. Phosphorus was higher on fertilized areas, but still inadequate.

Table 4. Crude protein and minerals in ungrazed native grasses, as affected by fertilizer, 1946-47. Moisture-free basis.

Season	Crude protein		Calcium		Phosphorus	
	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized
	<i>Percent</i>					
Spring	8.09	7.68	0.47	0.43	0.17	0.11
Summer	5.57	5.60	.55	.48	.13	.08
Fall	4.67	5.40	.53	.50	.13	.09

On plots open to grazing, fertilized areas were grazed closely by cattle throughout the year, while adjacent unfertilized areas were only lightly grazed. On fertilized areas thus closely grazed, the protein content of the forage averaged about 13 percent in spring and 9 to 10 percent throughout the summer. Calcium content was adequate, and phosphorus nearly so.

The Cattle Diet

The chemical analyses of various forage species in different stages and conditions of growth are very helpful, but the crux of the prob-

Table 5. Summary of composite cattle diet samples,¹ central Louisiana, 1944-1949, by months

Month	Samples	Total moisture	Free moisture	Bound moisture	Crude protein	Ether extract	Nitrogen-free extract	Crude fiber	Ash	Calcium	Phosphorus
		<i>Percent</i>									
		<i>Number</i>									
January	15	34.05	28.65	7.49	4.61	2.75	47.47	35.01	10.16	0.23	0.05
February	14	37.62	33.41	6.85	5.77	2.00	46.02	34.73	11.48	.24	.06
March	11	45.98	41.31	7.82	8.00	1.75	45.73	34.13	10.39	.25	.09
April	7	67.46	64.54	8.22	12.50	1.93	46.40	29.82	9.35	.29	.13
May	4	58.68	54.72	8.62	10.23	2.01	50.27	28.99	8.50	.32	.14
June	7	60.65	57.04	8.24	8.01	2.10	46.57	34.22	9.10	.35	.08
July	4	58.89	55.19	8.06	7.78	2.05	47.24	34.15	8.78	.36	.12
August	10	58.50	54.96	7.78	6.93	1.90	47.97	34.48	8.72	.37	.10
September	5	58.57	55.89	6.17	6.47	1.75	48.28	33.91	9.59	.29	.14
October	8	51.50	47.65	7.34	6.35	2.11	45.62	37.17	8.75	.37	.09
November	5	45.74	41.71	7.10	5.50	2.26	48.88	34.38	8.98	.35	.09
December	9	39.64	34.61	7.72	4.84	2.13	48.23	35.96	8.84	.23	.06

¹Total and free moisture are in percent of green weight, bound moisture is in percent of air-dry weight. Other constituents are on a moisture-free basis.

lem is the nutrient content of the forage actually grazed by livestock. For this reason, cattle grazing habits were observed closely and forage samples representing the cattle diet were collected at weekly or monthly intervals for six years. The nutrient contents of some 100 samples, averaged by months, are shown in Table 5. The average yearlong cattle diet on this range was approximately 62.9 percent bluestem grasses, 31.9 percent other grasses, 4.0 percent forbs or weeds, and 1.2 percent browse. The browse was grazed only in winter.

Crude protein in the cattle diet was above 9 percent only in April and May. In March it varied from a high of 13.40 percent in 1945, a warm, wet spring, to a low of 3.42 percent in 1949, a cold, late season. Usually, however, crude protein content of range grass in this area is adequate after about March 15. In June, protein varied from a high of 9.92 percent in 1947 to a low of 6.52 percent in 1944; but generally it was sufficient until the middle of the month. Thus crude protein was adequate or nearly so for an average of 3 months. Year by year, the period varied from $2\frac{1}{2}$ to $4\frac{1}{2}$ months, depending upon temperatures and rainfall during spring and early summer. For the maintenance of dry stock, crude protein was usually adequate (7 percent or more) for about 5 months from March 16 to August 15.

Since the protein content varies so greatly from season to season and year to year, it is important for the livestock owner to know approximately how much of this nutrient is present in the range forage his animals are currently grazing. Campbell and Cassady (3) have reported a close correlation between moisture content of the forage and crude protein.

For the central Louisiana range area they found two separate moisture-protein relationships: 1. relatively high protein for samples taken in spring when vegetation was growing rapidly; 2. relatively low protein for samples taken in summer, fall, and winter (Fig. 2). Thus, in early spring, average crude protein reaches 9 percent when the forage has 48 percent free moisture. Spring grazing can therefore begin when there is sufficient green herbage of 48 percent or more free moisture. In summer, fall, and winter, the forage is drier; on the average it falls below 7 percent crude protein at 53 percent free moisture, and below 6 percent at 43 percent moisture. The kind and amount of supplemental pastures or concentrates needed to meet protein requirements can be roughly estimated from the moisture content of the range forage.

On the rather well-drained sands and sandy loams of the study area, some deficiencies in calcium or phosphorus would be expected. The fact that calcium was usually adequate and that phosphorus was never present in adequate amounts was not anticipated. This emphasizes the need for mineral supplements that are high in phosphorus. Most commercial mineral mixtures contain considerably more calcium than phosphorus and would not be economical for use in this area. Probably there are also deficiencies during part or all of the year in such minor

minerals as manganese and cobalt, and in at least vitamins A and D, all necessary to animal health, reproduction, and growth.

Very likely the most urgent deficiency in cattle diet on the range is in energy. The deficiency often begins in mid-summer and worsens

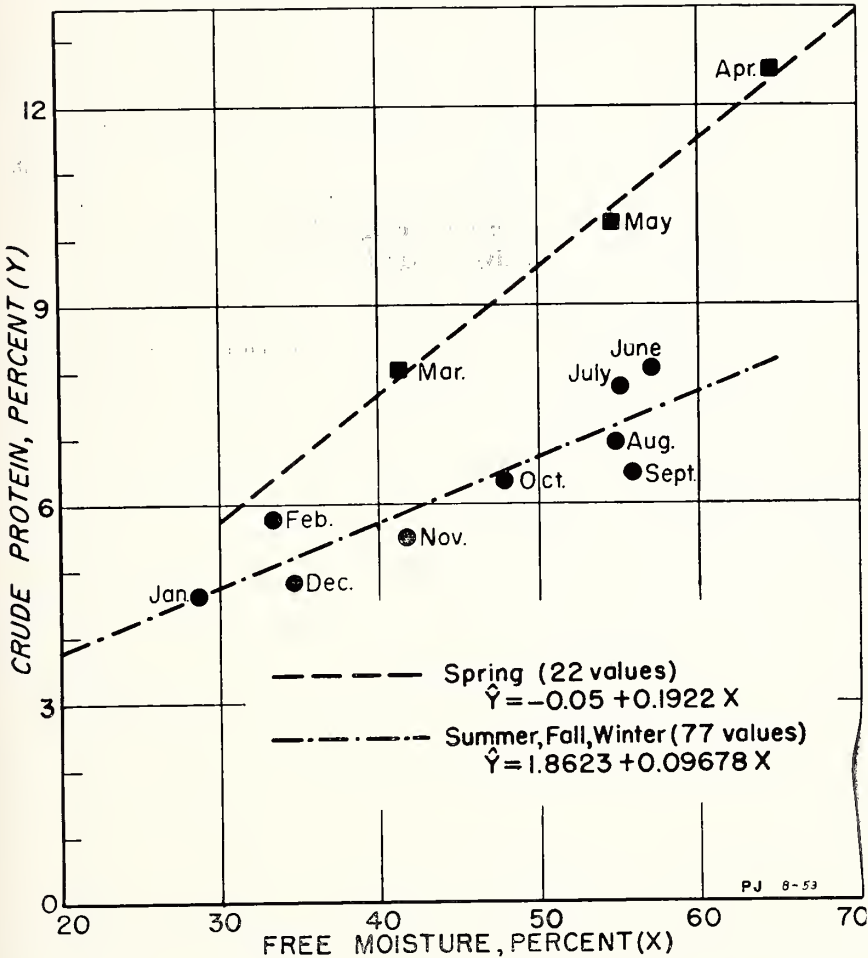


Figure 2. Average cattle diet, by months, on forest range in central Louisiana, 1944-49

through fall and winter, almost to the beginning of the next grazing season in mid-March. The gradual drop in crude protein as the growing season progresses apparently is accompanied by a decrease in the digestibility of the organic constituents of the forage.

Although no digestion trials have been run on these forest range samples, there is reliable evidence that such a decrease in digestibility takes place as forage matures. For example, timothy hay in the prebloom stage contains 11.9 percent crude protein (moisture-free), which is 54

percent digestible by cattle. The full bloom stage has 8.1 percent crude protein with a digestion coefficient of 49 percent; and the mature stage has 2.4 percent protein, which is only 42 percent digestible (12). Such decreases in digestion coefficients as the grasses mature may be related to the amount and location of lignification in the vascular bundles and surrounding tissues of the grass leaves and stems (11).

Digestion coefficients for southern range grasses were estimated from coefficients for fairly comparable roughages listed in Schneider (12) and in Morrison (9). The estimates were made for each organic constituent, by stages of grass development. The coefficients were applied to the data in Table 5 to estimate average digestible protein and total digestible nutrients of the native forage in the cattle diet from 1944 to 1949 (Table 6).

Table 6. Estimated digestible nutrients in forage on Louisiana forest range

Average period	Growth stage	Digestible protein	Total digestible nutrients
			Percent
March 16 to May 15	Early leaf	6.5	55
May 16 to July 15	Full leaf	4.3	49
July 16 to Oct. 31	Mature (green)	2.7	44
Nov. 1 to March 15	Winter rough	1.7	38

If a requirement of about 55 percent total digestible nutrients (moisture-free) is assumed, the table indicates that the forage provides adequate total energy for cattle breeding herds only when the animals can secure a fill of grass or other plants in the young-leaf and early full-leaf stages. The young-leaf stage of a single species lasts only a few weeks, but a succession of species of grasses and forbs furnishes succulent, nutritious grazing from about March 16 to May 15. Calves with their mothers, and steers on the range, do well during this period (2). Gains continue, but at a slower rate, from about May 16 to July 15, when grass leaves are fully grown but still fairly succulent.

During summer, from mid-July through October, cows with calves usually lose some weight, yearlings about hold their own, and calves make unsatisfactory gains. This is the period when the forage is mature though still green, with both total digestible nutrients and digestible protein well below cattle requirements. In winter, all classes of stock lose weight, even when a small amount of protein supplement ($\frac{1}{2}$ pound cottonseed cake per head per day) is fed.

Meeting Nutrient Deficiencies

The estimated deficiencies in protein, energy, and phosphorus at various stages of forage growth are summarized in Table 7. The table

is based on composite cattle diet samples taken on forest range in central Louisiana between 1944 and 1949.

Following are some possible means of meeting the deficiencies.

Spring (mid-March to mid-May). No protein or energy supplement is needed, but it is desirable to provide phosphorus-rich mineral mixture and induce each animal to consume an amount equal to about 2 pounds of steamed bone meal per head per month. If the cattle cannot be made to eat bone meal, some other source of phosphorus should be substituted.

Early summer (mid-May to mid-July). A small protein supplement is needed. It could be supplied by about 0.25 to 0.33 pound of cottonseed meal per head per day in salt-mineral mix. The cottonseed meal supplies some phosphorus, but an additional amount (equal to 2.5 pounds of steamed bone meal per head per month) should be fed.

Summer-early fall (mid-July through October). The cattle may be run on a pasture of Kudzu or millet, or other plants that will supply adequate protein and energy.

Table 7. Estimated content and needed supplements of selected nutrients in cattle diet on forest range, central Louisiana, by stages of forage growth¹

Stage of forage development	Digestible protein		Total digestible nutrients		Phosphorus	
	In forage	Supplement needed	In forage	Supplement needed	In forage	Supplement needed
	Percent	Pounds	Percent	Pounds	Percent	Ounces
Young leaf (March 16 to May 15)	6.5	0	55	0	0.13	0.1
Full leaf (May 16 to July 15)	4.3	0.1	49	1.0	.10	.2
Mature (green) (July 16 to Oct. 31)	2.7	.4	44	1.8	.10	.2
Winter rough (Nov. 1 to March 15)	1.7	.5	38	2.8	.06	.4
Recommended allowance	5.0	--	55	--	.18	--

¹Based on daily forage requirement per cow of 16.5 pounds, moisture-free basis.

Alternatively, if it is desired to keep the animals on forest range, they can be given about 1.0 pound of cottonseed meal per head per day, possibly in a salt-meal mix. The phosphorus in the cottonseed meal should be supplemented with the equivalent of 2.5 pounds of steamed bone meal per head per month.

Fall-winter (November to mid-March). Any one of the following feeding schemes should keep the animals in good shape:

1. The herd may be put on green winter pasture, such as oats or rye.

2. The forest range may be supplemented with about 5 pounds of clover or alfalfa hay. A mineral mix is needed to supply salt and phosphorus.

3. The forest range may be supplemented with about 5 pounds of grass hay, plus 1 pound of cottonseed meal per head per day. A mineral mix is also needed.

4. The range may be grazed mainly for roughage. The protein deficiency can be made up by feeding at least 1.5 pounds of cottonseed meal per head per day. The energy deficiency must be met by an additional supplement—for example, molasses feed at the rate of 3 pounds per head per day.

The proposals for all four seasons assume that the animals will consume about 16.5 pounds (moisture-free) of forage daily. If they do not consume this much roughage, the estimated deficiencies will be even greater, and more protein and energy supplements will be needed.

Methods of supplying mineral supplements vary widely. Some owners rely on commercial mineral blocks, some feed loose mixes, and some set out the various constituents in separate boxes. A range cattle study in south Georgia indicated that cows may not eat enough mineral supplement, when fed free-choice, to overcome completely the mineral deficiency of range forage (13). Special practices, such as mixing the minerals with protein meal or other supplemental feed, appeared desirable. Since range cattle ordinarily consume about 1 ounce of salt per head per day, the other ingredients can be mixed with the salt in the proportions needed to meet the deficiencies at various seasons of the year. Minor minerals, such as cobalt and manganese, may also be needed, and can be added to the mineral mix in very small amounts.

Vitamin content of range forage was not analyzed, but it seems probable that Vitamin A is needed as a supplement much of the year. It can be added to the mineral mix, in the form of alfalfa meal or its equivalent.

Summary

Forage samples, including some that represented actual cattle diet, were collected from native range in central Louisiana from 1944 through 1949. The samples, which were taken at all seasons of plant growth, were analyzed by the Feed and Fertilizer Laboratory of Louisiana State University. This bulletin reports the results of these chemical analyses; considers the effect of timber type, burning, grazing, and fertilizing on nutrient content of forage; summarizes the main deficiencies in the cattle diet on forest range; and suggests possible means for meeting these deficiencies.

Crude protein, calcium, and phosphorus contents at different stages of growth are presented for 32 forest range species. Most of the grasses contain adequate crude protein (9 percent or more, moisture-free) only in the young-leaf stage. All of the broadleaved herbs, collected at the stage in which they were being grazed, had adequate protein. The

browse plants with green leaves had enough protein, but were taken by cattle only in winter and then sparingly. Calcium appeared adequate (0.2 percent or more) in all the species sampled. Phosphorus content of grasses was highest in the young-leaf stage, but even that was below the animal diet requirements (0.18 percent or more).

Frequent grazing or harvesting keeps the protein content of the new growth high, but seriously reduces total production of forage. Repeated burning appears to have much the same effect. Relatively intensive grazing in spring and summer may lengthen the cattle gaining season without drastically reducing forage production.

No significant difference was found between the nutrients in green grass in open range, scrub oak, or pine forest types. Using a complete fertilizer on the native forage increased the herbage production 35 percent or more, but did not significantly raise protein contents of the mature plants. Calcium and phosphorus were significantly higher on the fertilized plots.

Forage samples representing cattle diet on the range had 9 percent crude protein only from about March 15 to June 15.

A close correlation was found between crude protein and moisture in the green sample. The relationship may be useful in determining the need for fresh pasture or supplemental feeds from season to season.

The energy values of range forage are grossly deficient during much of the year. Suggestions are made for meeting the estimated deficiencies with protein, energy, and mineral supplements.

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Hibiscus for the Yard

By

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The Crested Yellow

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AGRICULTURAL EXPERIMENT STATION

DOYLE CHAMBERS, *Director*

HIBISCUS FOR THE YARD

R. H. Hanchey and W. D. Kimbrough

INTRODUCTION

The ornamental or Chinese hibiscus as it may be called has greatly increased in popularity in Louisiana during the last few years. The scientific name of the Chinese hibiscus is *Hibiscus rosa-sinensis* L. but many of the present day varieties of hibiscus are the result of the hybridizing of several species. The hibiscus is one of the most popular flowering plants grown in tropical and subtropical areas and, though not cold hardy, is being grown in areas where it is subject to winter injury. It belongs to the mallow family, which contains several well-known plants such as cotton, hollyhock, turks cap, and the mallows. The genus *Hibiscus* also includes the shrub althea, confederate rose, and okra. The fringed hibiscus from Africa, the species *schizopetalus*, also belongs to this genus.

There are several reasons for the increased popularity of the hibiscus. Improved varieties, especially some of the doubles, that attract attention are an important one. The fact that hibiscus bloom at a time of year when other flowers are not too plentiful, or are of poor quality, is of considerable importance. The realization that hibiscus may be grown successfully in many areas where it had not been grown has been helpful. The personal interest of some nurserymen in hibiscus and their making plants of good varieties available at reasonable prices has given impetus to the popularity of the plant.

In areas where the hibiscus is not subject to winter injury it is a perennial. In nearly all of the state of Louisiana it is likely to be killed by cold. In the southern part of the state, especially when some protection is present, plants may grow a number of years without serious damage from cold. In most of the state protection of some sort is necessary if the plants are to survive from year to year. Winter protection will be discussed later. It is believed, however, that over most of the state the hibiscus can be grown successfully as an annual so far as most gardeners are concerned. Rooted cuttings may be carried over winter more easily than large plants. Growers may grow their own plants but for the majority it would be better for nurseries to produce and care for the plants over winter. Nurserymen have the "know how" and facilities and in most cases can produce plants cheaper than individuals. If the price of plants is reasonable they can be replaced every year if necessary and lots of blooms may be obtained for the money invested. With proper care large plants of vigorous varieties can be grown in one season from rooted cuttings.

ACKNOWLEDGMENT—Appreciation is expressed to Mr. Zahn of Zahn's Nursery, New Orleans, for contributing a number of varieties for planting in a variety test. Thanks is also expressed to Mr. Bagwell, of Bagwell's Nursery, West Monroe, for giving cuttings of several varieties.

An objection often given to growing hibiscus for cut flowers is that they will last only one day. This is true for most varieties, especially in hot weather. This means that fresh flowers would have to be picked every day. If the plants bloom well, flowers will be available most of the time and if no leaves are pulled with the blooms, picking flowers does not damage the plants. If blooms are wanted for decorations at night, they should be pulled as soon as they are well open in the morning and placed in the refrigerator. One advantage of hibiscus blooms is that they do not have to be kept in water. Many varieties produce blooms that are excellent for use as corsages.

VARIETIES

Hibiscus nomenclature is somewhat confused but efforts are being made to straighten out this situation. It still sometimes happens that different varieties may be bought under the same name or the same variety obtained with different names. For this reason there is an advantage to buying a plant that is in bloom or seeing blooms on stock plants in a nursery. There are many beautiful varieties of hibiscus on the market and others are certain to be introduced. They may be obtained in different colors and shapes from singles to very doubles. Some of the types found are illustrated on Pages 4 and 5. The growth of plants of different varieties is quite variable and this may be important from the landscaping viewpoint.

Here at the Experiment Station approximately 100 varieties have been grown. Based on growth and freedom of bloom in the plots several varieties will be suggested as worthy of trial. While most of the better known varieties have been tried, this does not mean that there are not many other excellent varieties that might do well in other areas or that have not been tried here. When grown for cut flowers the double type blooms are likely to be found more desirable, but for show in the yard the singles are often better. If space is available in the yard some of both types should be planted. Variety names used in this publication are those used by the sources from which plants were obtained, except where known errors were corrected.

There are a number of good double yellow varieties now available. They make good growth and produce blooms fairly freely. The following are believed to be among the better ones: Crested Yellow, Crown of Bohemia, Andersons 161, and Hendry's 111 or Butterfly. Certain varieties such as Crown of Bohemia may have some orange color in them at times. From observations here Crested Yellow is considered the best double yellow variety, though any of the others named should be satisfactory. The double yellows are not likely to bloom as profusely as some of the other varieties.

Probably the outstanding hibiscus variety at present is Kona. It produces very large double pink blooms. It is a profuse bloomer and a vigorous grower. The plant will be tall and possibly a little sprangly



Crested Yellow



Crested Yellow



Kona



Columbia



King of Tonga
Eleanor Gartley



Stella Lykes



Pride of Balic



Delicata



Schizopetalus



Psyche

under good growing conditions. If only one variety is to be grown, this is a good one to try.

Another variety that is a very vigorous, upright grower and produces double coral pink blooms of medium size is *Pride of Hankin*. This variety is worthy of trial.

Peach Blow is a good double pink. The plants make only fairly good growth but are profuse bloomers. The popularity of this variety is said to be waning, probably due to the fact that the blooms appear to be somewhat faded, but it can usually be counted on to produce many beautiful blooms.

Lambert's Red is a beautiful double variety that is often sold under other names. The flowers are dark red and the plant makes good growth of the spreading type. This is one of the best reds, if not the best.

Celia is another good double red. The plant makes fair growth and

the blooms are very nice. The color of the flowers is on the orange side of red.

One of the best double orange varieties is Alani. The plant makes good growth of a spreading type and produces large dark orange colored blooms.

Another good variety is Double Orange. The plants of this variety make fair growth, and large orange colored blooms are produced.

Jigora is a very good double variety. The plants make fair growth and produce medium-sized fairly double salmon blooms.

American Beauty (Subviolaceous) is one of the most popular double varieties. It produces large blooms of a rose red color. The plant is only fairly vigorous, but blooms are produced rather profusely. This is thought to be a good variety to plant.

Apex produces an orange yellow single bloom with a slightly darker center. Plants of this variety make good growth and bloom well. It is a good variety of the single type.

Another good single variety is Minerva. Plants of this variety make good growth and usually have a profusion of pink blooms.

Single Scarlet, a variety that is often called Brilliantissima in this area, is probably the most popular hibiscus variety at the present time. It is a dark red variety. The plants make vigorous growth and bloom well. There is another lighter colored variety that is sold under the name of Brilliantissima.

Indian Chief is an old single variety that produces good plants and lots of blooms. The flowers are large, single and the color orange-red with the back of the petals being bronze. Though some may consider this variety too common to plant, it is still a good one.

Delicata is a profuse blooming single variety. The flowers are pinkish lavender in color. The plants make good growth. This is considered to be an excellent variety.

Another variety that produces an abundance of blooms and makes excellent growth is Venus. The flowers are large and light pink in color and will last longer than blooms of many varieties. The flower may appear to be a little washed out. This variety is said to be very susceptible to nematode injury.

Agnes Gault produces very large satiny pink blooms. The plant is a strong grower and a free bloomer.

Painted Lady is a fairly light pink variety that grows and blooms well. The single flowers are not as attractive as many others.

Buttercup and Pink Beauty are two single varieties that have not been tested here but are said to be good.

There is a group of varieties producing single blooms that are very beautiful, but in tests here have not bloomed too freely and often have not made satisfactory growth. Among these are Luna, Florida Luna, Pride of Balic, Mrs. F. Anderson, Bride, Ruffled Giant, and Florida Gem. Of that group Florida Gem has been the best in bloom production and Ruffled Giant and Bride the worst. Even though fewer

blooms may be obtained, their beauty warrants growing these varieties.

There is a variety often sold as *Schizopetalus* which is really a species, *Hibiscus schizopetalus*. It is called the fringed hibiscus and is grown as a novelty. The flowers are small and the plant makes an upright rangy type of growth. Some of the hybrids of this variety are grown rather extensively. The plants of these hybrids produce small flowers but they usually bloom profusely. The most popular variety of this type is Psyche. The color of the bloom is red and the plant makes a vigorous growth. Dainty is another variety of this type and may be sold by the names La France and Shirley Temple. The blooms of this variety are a washed out pink, but the plant produces many blooms and makes good growth. A white sport of Dainty is called Dainty White or may be called La France White.

PROPAGATION

Hibiscus plants may be increased by sexual or asexual means. With the exception of certain species which may come true from seed, hibiscus plants must be propagated by some asexual method in order to obtain plants like the parent plant.

In general, hibiscus plants may be propagated by cuttings, grafting, and layering. The majority of the plants are propagated by cuttings.

Cuttings

Time of making the cuttings, rooting medium, root inducing materials, and proper care of the cuttings while in the propagating bed determine to a large extent whether or not cuttings form roots.

Time of Making Cuttings—Cuttings from varieties that root satisfactorily can be made at any time from new growth. In general, cuttings should be taken during August and September and carried over in a greenhouse to insure good plants for spring planting. Cuttings made early in the morning tend to be more turgid and are less likely to wilt in the propagating bed than those made during the middle of the day. Cuttings taken from old growth do not root as readily as those made from new growth. Terminal tips 5 to 7 inches in length are a good size to use. The lower leaves should be removed and the upper ones left intact when the cutting is placed in the cutting bed.

Propagating Bed—The propagating bed should have sides 6 to 8 inches high and good bottom drainage. Unbleached sheeting or similar material should extend above the bed 24 to 30 inches on all sides. The sheeting helps in keeping a uniform high humidity. If a greenhouse bench is available the sheeting is unnecessary if the greenhouse is well shaded.

Rooting Medium—Vermiculite is a very satisfactory rooting medium for hibiscus cuttings. Many varieties form roots in 20 to 30

days when placed in this material. The roots formed on cuttings in vermiculite are larger than those formed in sand. Cuttings also root faster and form more roots in vermiculite than in sand.

A mixture of 1/2 sand and 1/2 vermiculite by volume is also a good rooting medium. Sand alone has been used satisfactorily, and 2/3 sand and 1/3 peat by volume has also been used with fair results. Good drainage is essential in the cutting bed if good results are expected.

Cuttings should be stuck in vermiculite and it should not be packed around the cuttings. Those unfamiliar with vermiculite may tend to keep it too wet and thus cause cuttings to rot.

Root Inducing Materials—The high concentration root inducing materials should not be used on hibiscus cuttings. Hormodin No. I and Hormodin No. II should be used rather than Hormodin III. Rootone should be used rather than Rootone No. 10. The weaker concentration of other commercial preparations should be used instead of the higher concentrations.

The use of one of these materials will aid in faster rooting of the cuttings and more total roots per cutting will be produced. The faster rooting decreases the time cuttings have to stay in the cutting bed and lessens the danger of rot caused by overwatering and disease organisms.

Making the Cutting—Cuttings should be taken from semi-mature growth on healthy, vigorous plants. Growth exposed to light is more satisfactory than lower growth that has been shaded. The cuttings should not be taken during the middle of the day if the stock plant is in a wilted condition. They should be kept cool, moist, and shaded until placed in the cutting bed. Cuttings of 5 to 7 inches in length are excellent. Most of the upper leaves should be left on the cutting and flower buds removed if present. The angle at which the cut is made and the angle at which the cutting is placed in the propagating bed does not affect root initiation or root development. The base of the cutting should be dipped in water and 1/4 - 1/2 inch of the base should be dipped in a suitable hormone preparation and the excess dust should be removed by tapping the cutting lightly on the container. Six-inch cuttings should be stuck 2 to 3 inches deep in a rooting medium that has been thoroughly watered down prior to sticking the cutting. Cuttings may be spaced in the cutting bed with their leaves touching. The cuttings should then be syringed frequently and the humidity in the propagating bed kept at a high level.

After rooting, the cuttings should be placed in 6-inch containers, pots or cans. A good potting mixture for hibiscus is 2 parts soil, 1 part well-rotted manure, 1 part peat, and 1 part sand by volume. Cuttings made in August and September, then potted and grown in a greenhouse during the winter months will have flower buds set when taken to the field the following spring but will not reach a peak blooming period until the days get somewhat longer.

Grafting

In selecting a rootstock, only fast, vigorous growing, easy-to-root kinds should be used. Varieties like Single Scarlet, Painted Lady, and Indian Chief should be satisfactory. The rootstock is propagated by cuttings and then grown in containers until of sufficient size to graft. The side wedge graft is a method used by many nurserymen in the propagating of hibiscus. If whip grafting is used, plants slightly larger than a pencil are satisfactory as a rootstock. The same size is good for budding. The "T" or shield type of budding is most often used. Slightly larger rootstocks are needed if the cleft method of grafting is to be used.

Any variety that roots well and makes vigorous growth should be propagated by cuttings rather than by grafting, as this method of propagation is more economical. Only slow growing varieties or those susceptible to root rot and nematode injury should be grafted and they should be grafted on vigorous growing, disease resistant varieties.

Layering

Hard-to-root varieties can be air layered.

Select a stem approximately 1/2 inch in diameter and girdle it 12 to 14 inches from the tip. This is done by removing about 1 inch of bark around the stem. Dust one of the hormone preparations on the wounded area. Cover the whole area with sphagnum moss and make secure by tying. Then wrap newspaper around the sphagnum moss. Keep the sphagnum moss in a moist condition until roots have formed. Some of the plastic and cellophane materials have been used satisfactorily as a covering over the sphagnum moss. When roots have formed, the branch can be cut off below the roots and the branch treated as a rooted cutting.

Seed

Propagation by seed is usually only practiced in an attempt to obtain new varieties. In general, seed set is better during the winter months from plants grown in a greenhouse than it is from plants grown outdoors in the summer in this area.

After the seed are harvested they can be planted in an equal mixture, by volume, of sand and peat. After germination the seedlings should be handled in the same manner as rooted cuttings. Some seedlings will bloom within 6 to 12 months.

PREPARATION OF SOIL AND PLANTING

The soil should be prepared well in advance of the time for setting out plants. If the soil is lacking in organic matter, well-rotted manure or compost should be added. Plants should be set where they will be exposed to as much sunlight as possible, as good bloom production cannot be expected where there is much shade. The best time to plant in the yard is when the danger of frost is well past. This time will vary in

different sections of the state but in the Baton Rouge area should be about the middle of April. During cool weather very little growth can be expected. The spacing of plants should vary somewhat depending on whether the plants are to be treated as annuals or perennials. When they are to be treated as annuals they should not be spaced closer than three to four feet apart. The plants are usually obtained as container plants or they are balled and burlapped. In either case care should be taken not to break the ball of soil when the plants are transplanted.

CARE OF PLANTS

Under good conditions hibiscus plants will make rapid growth during hot weather. If fertilizer is needed, and likely it will be beneficial, it should be applied to the soil when preparations for planting are made or a week or so after transplanting the plant. About 1/8 pound of 8-8-8 or an equivalent amount of any other good fertilizer analysis should be sufficient for small plants. The amount of fertilizer to apply should be based on the analysis of nitrogen in the one used. If needed, other applications of fertilizer may be added during the growing season. Usually some source of easily available nitrogen, such as nitrate of soda, is all that is needed if a complete fertilizer is used for the first application.

To thrive hibiscus plants must not suffer from lack of water. This is especially true from transplanting time until developing new roots insure that the plant is well established. As with other plants, when watering is done it should be done thoroughly and not too frequently. The leaves of the plant should not be allowed to wilt.

Under favorable conditions there seems to be a tendency for vigorous growing hibiscus plants to make proportionately more top than root growth. This causes the plants to fall over easily if exposed to winds. To prevent the plants from falling over, it is suggested that plants be staked before they get very large. If cord is used to tie the plant to the stake it should be watched to see that it does not rot or weaken to the extent that it cannot hold the plant. The hibiscus root system seems to be rather shallow, at least under conditions in the area around Baton Rouge. If a plant happens to be blown over it should be tied up again as soon as possible. If this is done plants will usually not suffer serious injury.

Weeds and grass should be kept from around the base of the plant. In doing this care should be taken not to damage the shallow root system. If a good mulch material, such as oak leaves or pine straw, is available it could be used to help conserve moisture and to help keep down weeds and grass.

DROPPING OF BUDS

One of the problems often encountered when growing hibiscus is the dropping of buds. This seems to be the result of several causes such

as various extremes. If the soil in which the plants are growing becomes too dry, buds will fall. When the plant is making extra vigorous growth, buds may fall. If there is too much shade, very few buds will likely be formed and, if so, some may fall. Cool weather may cause buds to drop prematurely. Some varieties seem to be worse than others about dropping buds. Usually hibiscus plants are grown for their flowers and unless good production is obtained the plants have not served their main purpose. Even though buds may drop from a number of causes, most good varieties can be expected to bloom well during warm weather if properly cared for.

USE OF BLOOMS

During warm weather the blooms of most of the varieties of hibiscus last for only a day. They open in the morning and cannot normally be used for decorative purposes that night. The time of opening varies somewhat with different varieties. Hibiscus flowers can be used the night following the morning they open if they are removed from the plants as soon as they are fully open and stored at temperatures of from 35° to 45° F. They may be kept in a home refrigerator. Hibiscus blooms make excellent corsages and are very good decorative flowers. The stems do not have to be kept in water, after they are pulled, to prevent wilting. The plants are not damaged by removing the blooms if no leaves are removed. Even though the blooms last but a day, free blooming varieties will furnish an abundance of flowers during the normal blooming season.

WINTER PROTECTION

Hibiscus plants are not hardy as far as cold damage is concerned. This means that if plants are grown in areas where they will be subjected to freeze injury they must be treated as annuals or protected over the winter. It is possible for plants to be killed to the ground in mild winters and then come out the next year even where no protection has been attempted. In this case if grafted plants have been killed below the graft union, only new shoots from the stock will be obtained. If plants are to be protected over winter, the protection should be given before the plant is subjected to a damaging freeze. Plants should be cut back to within 8 to 12 inches of the ground and covered with some loose material such as oak leaves, pine straw, etc. The material should stay around and over the plant until the danger of freeze injury has passed. Some varieties are more easily carried over winter than others. Where greenhouses or other places where plants may be carried over winter are available, plants may be placed in containers and protected there.

PESTS

Hibiscus, as with nearly every worthwhile plant that grows, is attacked by a number of pests. So far it does not have as many pests as

many other important ornamental plants. It is, however, subject to injury from the root knot nematode and probably other types of nemas. There appears to be some difference in varietal susceptibility to root knot nematode. This is a serious pest and very difficult to control. The best control is soil treatment.

The plants are subject to infestation by certain scale insects and if these are not controlled serious damage may result. They can be controlled by spraying with malathion at the rate of $1\frac{1}{2}$ teaspoons of 50 per cent material per gallon of water. This material will also control mealy bugs.

Aphids may be frequently found on the growing points of the shoots and on flower buds and blooms. These may be controlled by malathion, nicotine sulphate, or Lindane.

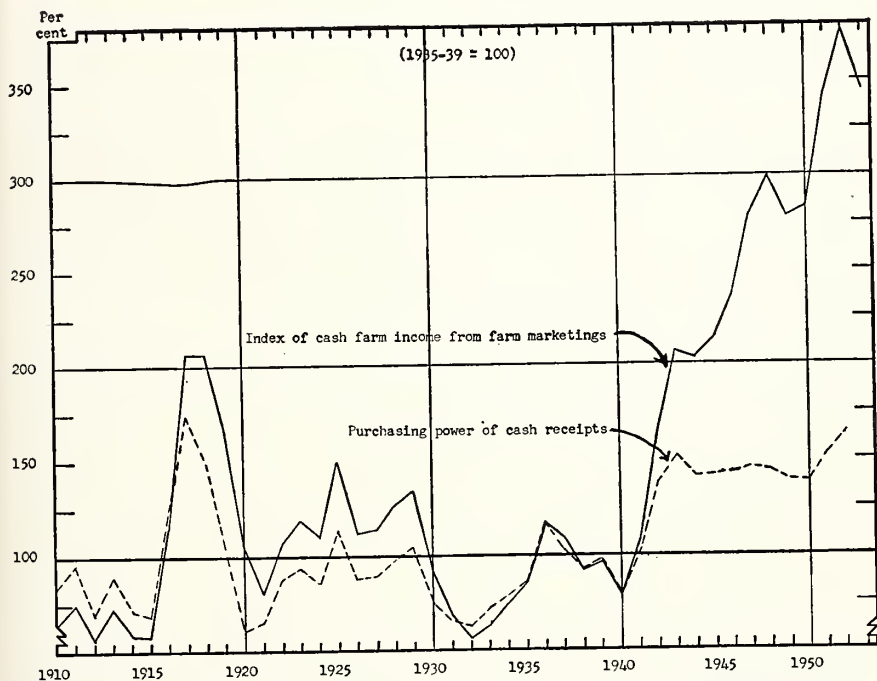
The corn earworm, also called the cotton bollworm, may attack the buds and greatly reduce the number of blooms produced during the period of infestation. They may be controlled by spraying with DDT at the rate of one tablespoon of 50 per cent wettable powder per one gallon of water.

Ants are a pest that, while not damaging the plant, are often a nuisance when found in large number in blooms that have been picked. These may be controlled by spraying the lower part of the plant and the soil around the plant with chlordane. Use three tablespoons of 50 per cent wettable powder per gallon of water. One spraying should last several weeks.

Agricultural Statistics For Louisiana, 1909-1953

by
J. P. MONTGOMERY

INDEXES OF CASH RECEIPTS AND OF PURCHASING POWER FROM
FARM MARKETINGS, LOUISIANA, 1910-53



Louisiana farmers received much greater cash income from farm marketings after 1940 than before that year but prices paid by farmers rose also thereby taking some of their income gains away from them.

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, Director

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Agricultural Statistics for Louisiana

1909-1953

BY J. P. MONTGOMERY

DEPARTMENT OF AGRICULTURAL ECONOMICS
AGRICULTURAL EXPERIMENT STATION

The major purpose of this publication is to provide agricultural data on Louisiana agriculture for farmers, educators, agricultural workers, and commercial, industrial, and financial institutions. These data should be of value in analyzing past agricultural experiences and in planning future operations.

The compilations were made from releases by the Louisiana Crop Reporting Service and other releases by the United States Department of Agriculture. The Crop Reporting Office in Louisiana represents both the United States Department of Agriculture and Louisiana State University. Formal cooperation exists between the Department of Agricultural Economics of the University and the Louisiana Office of Agricultural Estimates, Agricultural Marketing Service, United States Department of Agriculture. The tables are compiled from established series which are released regularly by the Louisiana Cooperative Crop Reporting Service or by the Department of Agriculture in Washington and therefore can be kept up to date.

This bulletin makes the data on Louisiana agriculture more readily available to agricultural workers and others affected by changes in agricultural conditions. The publication comprises statistics on the more important agricultural enterprises and commodities for Louisiana from 1909 through 1953. The tables show the data in five-year averages from 1909 through 1943 and on an annual basis thereafter. The five-year averages are used through 1943 because Louisiana Bulletin No. 444 provides annual data prior to that date. A considerable number of revisions have been made in the data shown in Louisiana Bulletin No. 444, *Agricultural Statistics for Louisiana, 1909-1949*, since that bulletin was published. The revised estimates are shown in this publication.

These data include production, disposition, price, and value of various livestock and livestock products in Louisiana, as well as acreage, yield, production, price, and value of the more important crops produced in the state from 1909 through 1953. Attempts have been made to organize the data in such tables that they will be of the greatest value to those in need of information on Louisiana's agriculture in time series.

The data in this publication are the latest official statistics of the United States Department of Agriculture with the exception of those in Tables 1 and 2, which are taken from releases by the Bureau of the Census, United States Department of Commerce.

The "cash receipts" data shown in the tables represent the monetary returns from farm marketings during the calendar year. The "value of production" information, however, represents the total farm value of the commodity produced during the crop year whether sold, consumed on the farm, or wasted. The average sale price of that sold applies also to the portion of the crop unsold in computing total farm value. Cash receipts are shown on a calendar-year basis, while value of production is shown on a crop-year basis. In a few tables, the data shown represent the value of sales. These represent the portion of the commodity sold during the crop year, excluding any unsold portions whether due to farm consumption or to economic abandonment.

Table 1—Distribution of crop acreage by crop reporting districts—1950 Census

Crop	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	State total
	Per cent of total state acreage harvested									
Cotton	17.5	11.1	34.9	5.8	20.1	2.8	3.5	4.2	0.1	100.0
Rice	—	—	0.5	—	12.7	0.1	82.0	4.0	0.7	100.0
Sorghum, all	11.5	18.7	40.1	3.9	9.5	10.1	3.0	2.0	1.2	100.0
Irish potatoes	5.9	10.1	3.1	3.6	26.1	15.5	4.6	9.7	21.4	100.0
Sweet potatoes	3.1	3.5	2.3	1.3	46.8	8.5	12.8	20.6	1.1	100.0
Corn, all	7.7	12.0	19.5	4.4	24.2	11.4	3.6	11.6	5.6	100.0
Oats for grain	19.1	7.0	43.7	4.3	8.0	9.4	7.6	0.5	0.4	100.0
Oats for sirup	7.0	13.3	3.3	8.8	21.0	21.2	4.5	15.7	5.2	100.0
Sugar cane for sirup	*	—	—	—	9.7	1.3	1.6	53.0	34.4	100.0
Sugar cane for sugar	0.2	0.2	*	*	7.9	1.1	0.9	58.2	31.5	100.0
Sugar cane for seed	4.0	3.6	34.2	0.1	7.0	4.0	3.0	28.0	16.1	100.0
Soybeans, all	0.8	2.1	89.2	0.2	5.0	0.4	1.1	0.5	0.7	100.0
Soybeans for beans	10.5	10.1	15.1	3.6	8.0	11.8	6.0	26.0	8.9	100.0
Soybeans for hay	2.0	10.6	37.0	2.5	19.3	6.0	4.5	4.0	14.1	100.0
Soybeans for silage	19.9	35.0	6.4	10.5	5.1	13.5	2.9	1.7	5.0	100.0
Cowpeas, all	26.5	43.6	6.9	12.0	5.0	3.0	2.0	*	1.0	100.0
Cowpeas for dry peas	18.3	47.9	2.8	9.8	7.2	9.0	3.5	0.2	1.3	100.0
Cowpeas for green peas	11.2	29.1	3.1	5.2	2.6	39.9	4.5	1.1	3.3	100.0
Cowpeas cut for hay	19.9	36.9	10.5	15.2	7.6	4.0	4.9	*	1.0	100.0
Cowpeas cut for silage	27.1	36.9	1.0	13.7	6.1	5.0	9.2	0.8	0.2	100.0
Peanuts, all	28.0	38.8	1.4	10.6	4.8	8.0	7.7	0.3	0.4	100.0
Peanuts for picking	23.0	42.3	0.4	16.0	7.0	1.1	10.1	—	0.1	100.0
Peanuts saved for hay	7.4	7.1	5.4	16.4	7.6	39.4	4.0	0.2	12.5	100.0
Velvet beans, all	78.2	1.0	5.2	5.7	5.5	2.1	0.5	0.9	0.9	100.0
Alfalfa cut for hay	7.1	1.9	4.9	8.1	37.1	23.6	2.9	7.5	6.9	100.0
Clover or timothy cut for hay	7.7	9.4	39.0	3.3	14.0	12.8	10.9	2.1	0.8	100.0
Lepedza cut for hay	8.0	5.2	11.3	10.9	26.2	13.0	7.3	10.2	7.9	100.0
Hay cut, other										

Source: Compiled from V.1-pt. 24, 1950 United States Census of Agriculture, U. S. Department of Commerce, Bureau of the Census.

*Less than one-tenth of 1 per cent.

Table 2.—Farms, farm property and farm population, 1910-50 Censuses

Item	Unit	1950	1945	1940	1935	1930	1925	1920	1910
Farms	Number	124,181	129,295	150,007	170,216	161,445	132,450	135,463	120,546
Land in Farms	Acres	11,202,278	10,039,657	9,996,108	10,444,288	9,355,437	8,837,502	10,019,822	10,439,481
Average Size of Farms	Acres	90.2	77.6	66.6	61.4	57.9	66.7	74.0	86.6
Total Cropland	Acres	5,657,467	5,135,416	6,038,067	5,876,097	5,656,234	5,064,031	5,626,226	5,276,016
Average Cropland per Farm	Acres	45.6	39.7	40.3	34.5	35.0	38.2	41.5	43.8
Value of Farms (land and buildings)	Dollars	870,632,991	472,327,792	353,873,506	295,515,197	418,191,773	524,678,074	474,038,793	237,544,450
All Farm Operators	Number	124,181	129,295	150,007	170,216	161,445	132,450	135,463	120,546
Full Owners	Number	62,810	58,761	52,936	54,891	46,893	47,913	51,895	48,570
Part Owners	Number	11,584	6,433	7,376	6,429	6,266	4,473	5,359	4,399
Managers	Number	588	560	528	519	735	503	828	950
Tenants	Number	49,199	63,541	89,167	108,377	107,551	79,561	77,381	66,607
Total Population	Number	2,683,516	2,291,000	2,363,880	2,266,023	2,101,593	1,972,085	1,798,509	1,656,388
Farm Population	Number	567,455	594,127	853,949	859,351	830,606	696,179	786,050	---
Per Cent of Total	Per cent	21.1	25.9	36.1	37.9	39.5	35.3	43.7	---

Source: U. S. Census Reports, Bureau of the Census

Table 3—Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Cotton	Sugar cane		Rice	Cow-peas for peas	Corn		Oats	Beans		Hay					
		Sugar	Thou- sand Acres			All	Thou- sand Acres		Thou- sand Acres	Soy- beans Acres	Vel- vet Acres	All	Alfalfa Acres	Lespe- deza Acres	Legume Acres	Misc.
1909	931	313	17.7	370	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	30	Thou- sand Acres	Thou- sand Acres	179					
1910	870	326	25.0	360		1,592	1,700	35			187					
1911	938	336	32.5	350		1,700		36			182					
1912	922	255	39.0	315		1,560		30			170					
1913	1,117	284	38.0	350		1,600		36			176					
1914	1,220	250	29.0	320		1,620		40			174					
1915	916	238	30.0	385		1,660		60			204					
1916	1,127	259	38.0	435		1,560		56			199					
1917	1,252	285	45.8	485		1,600		52			201					
1918	1,441	263	65.8	565		1,600		51			198					
1919	1,304	233	22.0	543		1,523		50			203	8			85	
1920	1,243	247	19.0	676		1,462		35			200	8			85	
1921	1,099	272	19.0	549		1,580		27			210	12			94	
1922	1,032	295	23.0	555		1,375		24			222	17			108	
1923	1,255	286	29.0	474		1,278		25			235	20			119	
1924	1,427	251	52.0	430	32	1,250		17	8	40	212	12	41	111	111	
1925	1,727	236	23.0	414	33	1,225		14	12	41	195	10	29	103	103	
1926	1,802	161	34.0	492	23	1,127		12	18	36	188	8	32	97	97	
1927	1,448	89	15.0	520	30	1,161		11	21	35	206	9	24	120	120	
1928	1,836	146	23.0	495	22	1,242		15	17	37	201	10	23	113	113	
1929	1,934	198	20.0	465	25	1,190		15	21	38	203	12	24	109	109	58
1930	1,953	191	26.0	491	33	1,190		14	16	37	217	11	25	129	129	52
1931	1,825	186	21.0	458	43	1,368		31	12	41	236	17	29	125	125	65

Continued

Table 3-- (Continued) --Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Cotton	Sugar cane		Rice	Cow-peas for peas		Corn		Oats		Beans		Hay						
		Sugar	Sirup		Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	All	Hybrid	Thou- sand Acres	Thou- sand Acres	Soy- beans	Vel- vet	All	Alfalfa	Lespe- dera	Legume	Misc.
1932	1,688	229	19.0	415	51	1,505	25	22	25	10	45	273	19	27	163	64			
1933	1,295	219	24.0	395	54	1,429	22	7	49	156	74								
1934	1,189	247	27.0	415	71	1,596	32	8	57	322	18	33	169	102					
1935	1,268	261	25.0	412	62	1,628	57	9	58	300	19	37	58	166	300	76			
1936	1,401	247	24.0	479	64	1,547	46	20	66	296	21	49	147	75					
1937	1,569	285	26.0	517	64	1,485	52	12	68	288	23	45	149	64					
1938	1,119	291	26.0	494	66	1,693	57	14	64	296	24	40	163	59	63				
1939	1,120	255	29.0	485	58	1,647	4	60	16	78	313	29	56	155	63				
1940	1,130	242	26.0	469	63	1,548	6	78	15	89	329	33	70	145	68				
1941	1,014	255	24.0	545	65	1,440	16	86	16	97	350	32	80	145	79				
1942	1,001	294	24.0	615	54	1,296	23	100	72	89	320	22	85	120	74				
1943	982	276	29.0	603	44	1,270	27	132	33	90	344	21	88	110	104				
1944	850	266	29.0	561	23	1,168	45	152	23	41	331	22	117	60	109				
1945	750	253	45.0	584	18	1,075	53	131	23	25	326	20	116	54	120				
1946	700	278	43.0	589	15	1,000	83	100	26	22	319	19	109	54	117				
1947	770	286	36.0	613	19	960	148	100	23	18	300	16	104	64	123				
1948	890	298	11.0	631	20	902	167	80	33	8	294	19	102	56	116				
1949	950	301	11.0	593	17	758	196	70	23	4	295	22	91	57	122				
1950	715	295	12.0	551	13	834	270	48	37	5	289	20	89	23	131				
1951	935	279	9.0	612	9	709	254	43	38	3	298	19	98	23	134				
1952	890	295	8.0	581	12	666	278	48	41	2	343	22	108	20	154				
1953	935	301	5.0	593	13	546	260	75	40	2	321	22	81	25	177				

Continued

Table 3—(Continued.)—Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Peanuts	Irish potatoes	Sweet potatoes	Tobacco, perique	Snapbeans		Cabbage, commercial	Water-melons, commercial		Cucumbers		Tomatoes	Onions	Carlic
					Spring	Fall		Thou- sand Acres	Thou- sand Acres	Spring	Fall			
1909	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres
1910	5	20	57											
1911	4	25	55											
1912	5	22	57											
1913	4	20	56											
1914	4	21	60											
1915	5	20	58											
1916	6	22	62											
1917	8	20	64											
1918	9	23	62											
1919	8	34	64		1.40		1.40						1.56	
1920	6	20	68	0.8	1.50		1.54						0.97	
1921	7	22	72	0.8	1.30		1.48						1.08	
1922	8	23	73	0.9	2.00		1.58						1.01	
1923	8	24	64	1.1	1.46	0.3	1.67						1.10	
1924	6	24	50	0.8	1.54	0.7	2.00			0.25			1.20	
1925	5	29	60	0.8	3.20	0.9	1.80			0.45			1.67	
1926	6	33	66	0.1	5.00	3.2	2.50			0.50		1.02	2.32	
1927	9	36	83	0.1	5.50	3.3	3.00			0.70		1.69	2.75	
1928	7	38	62	0.2	6.20	3.6	3.20	3.00		0.65		1.68	2.90	
1929	8	29	67	0.3	7.40	3.2	3.50	2.70		0.90	0.80	1.20	2.30	
1930	8	34	60	0.6	8.00	4.0	3.10	2.50		0.66	0.78	1.10	2.20	
1931	10	48	83	0.6	8.40	3.6	2.10	2.30		0.80	0.85	1.20	1.26	
					8.00	2.6	5.40	2.20		0.40		1.30	1.10	

Continued

Table 3-- (Continued) --Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Peanuts	Irish potatoes	Sweet potatoes	Tobacco, perique	Snapbeans		Cabbage, com- mercial	Water- melons, com- mercial	Beets	Cucumbers		Tomatoes	Onions	Garlic
					Spring	Fall				Spring	Fall			
	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres
1932	14	40	111	0.4	7.60	2.6	3.20		2.10	0.45	0.95	1.60	1.20	0.50
1933	12	38	98	0.3	4.50	3.7	2.20		2.10	0.45	0.90	2.10	0.50	0.50
1934	12	42	117	0.1	8.00	4.9	9.30	2.9	2.20	0.48	0.65	2.20	1.60	0.70
1935	12	39	123	0.1	8.80	5.6	1.80	3.1	2.00	0.60	0.85	2.70	1.20	0.70
1936	11	39	111	0.1	8.80	6.2	3.60	4.9	1.50	0.50	0.75	2.80	1.10	0.50
1937	10	44	97	0.4	9.20	4.4	4.20	4.8	1.50	0.55	0.80	2.80	1.70	0.60
1938	11	43	109	0.6	10.90	3.7	3.80	4.6	1.10	0.50	0.90	3.10	1.70	0.75
1939	11	40	95	1.0	9.20	4.0	4.60	8.0	1.10	0.50	1.20	2.60	1.70	0.75
1940	11	40	86	0.5	7.50	4.4	4.60	7.2	1.00	0.55	0.90	2.90	1.10	0.70
1941	8	43	90	0.2	6.60	3.0	4.60	6.8	0.90	0.60	0.90	3.00	1.70	0.65
1942	24	42	88	0.2	7.40	2.4	5.70	5.4	0.80	0.60	0.75	2.90	1.25	0.70
1943	20	57	124	0.3	8.00	2.1	5.10	4.8	0.70	0.48	1.00	2.80	1.55	0.48
1944	5	59	100	0.4	6.00	2.2	8.30	6.7	0.70	1.00	1.50	2.50	1.80	0.38
1945	5	38	116	0.3	6.00	3.0	7.50	6.4	0.50	0.85	1.20	2.20	2.00	0.31
1946	4	33	125	0.3	7.20	2.9	7.40	7.4	0.50	1.40	1.80	1.80	2.00	0.25
1947	5	24	94	0.6	5.40	2.4	8.00	6.2	0.35	0.80	0.90	1.50	1.10	0.18
1948	3	17	86	0.3	4.50	2.0	5.00	5.2	0.25	0.75	0.90	1.30	0.45	0.13
1949	3	14	92	0.3	3.70	2.2	5.30	4.7	0.30	0.65	1.10	1.40	0.50	0.10
1950	3	14	107	0.4	4.40	2.2	5.60	4.5	0.20	0.60	1.20	1.20	0.45	0.09
1951	3	12	73	0.4	4.20	1.8	1.80	3.9	0.12	0.60	0.90	1.10	0.40	0.06
1952	2	10.6	88	0.35	4.00	1.7	3.00	3.5	0.10	0.60	0.90	1.10	0.35	0.05
1953		11.6	96	0.25	3.80	1.5	5.20	2.8	0.10	0.45	1.00	0.60	--	--

Continued

Table 3—(Continued.)—Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Shallots		Egg-plant	Green Peppers, Fall	Carrots	Spinach	Vegetable crops for processing	Straw-berries	White clover seed	Lespe-dera seed	Total in selected crops	Total acres harvested ¹
	Spring	Winter										
	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres	Thou- sand Acres
1909												
1910											3,514,700	3,585,619
1911											3,587,000	
1912											3,658,500	
1913											3,371,000	
1914											3,383,000	
1915											3,736,000	
1916											3,583,000	
1917											3,766,000	
1918											4,014,800	
1919								4.90			4,299,060	
1920								3.90			3,980,710	3,924,267
1921								6.50			3,994,160	
1922								8.25			3,783,740	
1923								11.56			3,639,190	
1924					1.22			14.35			3,689,160	
1925				0.85	1.27			14.60		12.0	3,836,540	3,484,753
1926			0.40	1.70	2.36	1.90		10.34		14.0	4,062,040	
1927			0.54	2.00	3.75	1.70		18.50		12.0	4,053,530	
1928			0.68	1.60	4.75	1.65		21.10		5.4	3,720,280	
1929			0.65	2.10	2.50	2.10	3.64	23.20		5.0	4,202,420	
1930			0.60	1.30	2.30	2.00	2.24	24.00		4.5	4,272,630	4,068,161
1931			0.50	1.15	2.30	1.99	5.84	22.00		4.8	4,324,740	
1932				1.10	2.20	1.50	2.62	20.50		4.2	4,417,070	

Continued

Table 3--(Continued) --Acres of land used in the production of selected crops, Louisiana, 1909-53

Year	Shallots		Egg-plant	Green Peppers, Fall	Carrots		Spinach	Vegetable crops for processing		Straw-berries	White clover seed	Lespe-dera seed	Total in selected crops	Total acres harvested ¹
	Thou- sand Acres	Thou- sand Acres			Thou- sand Acres	Thou- sand Acres		Thou- sand Acres	Thou- sand Acres					
1932														
1933			0.50	0.90	2.20	1.20	1.63	23.00					4,478,730	
1934			0.50	1.05	2.10	1.20	1.11	18.80					3,964,510	
1935			0.55	1.05	2.10	1.50	1.68	19.40					4,197,510	3,977,024
1936			0.65	1.25	1.90	1.20	2.23	18.80					4,310,380	
1937			0.55	1.30	1.90	1.10	2.68	14.80			10.0		4,417,780	
1938	2.8	3.2	0.50	1.20	1.90	1.10	3.68	17.60			8.6		4,591,530	
1939	2.7	3.0	0.75	1.60	2.20	1.20	3.30	22.00			6.7		4,360,600	
1940	2.4	3.0	0.70	1.40	2.20	1.40	2.10	23.10			6.2		4,293,500	4,051,670
1941	2.0	2.7	0.60	1.20	2.00	1.40	4.15	20.70			8.1		4,213,100	
1942	1.9	2.2	0.55	1.30	2.00	1.20	4.65	22.60			9.5		4,132,850	
1943	2.4	2.8	0.50	1.20	1.80	1.20	5.60	20.50			11.4		4,128,500	
1944	2.3	2.7	0.50	1.60	1.70	1.00	5.80	13.90			11.8		4,106,610	
1945	2.1	1.9	0.45	1.80	1.50	1.00	4.30	9.50			11.8		3,730,830	3,490,159
1946	2.2	2.7	0.40	2.00	1.50	0.90	3.45	10.50			8.6		3,514,510	
1947	2.2	3.2	0.40	2.50	0.90	0.90	3.62	15.40			8.0		3,414,270	
1948	2.0	2.7	0.35	2.50	0.80	0.80	3.19	17.80			12.0		3,468,570	
1949	1.9	2.9	0.33	2.70	0.75	0.65	1.83	14.40			11.0		3,500,740	
1950	1.6	2.9	0.30	3.00	0.70	0.60	1.78	13.40			7.0		3,380,830	3,148,881
1951	1.9	2.6	0.30	2.70	0.65	0.50	2.00	13.30			5.1		3,244,190	
1952	2.0	3.0	0.30	2.90	0.55	0.40	1.25	13.40			17.5		3,335,380	
1953	2.5	3.5	0.30	2.80	0.55	0.30	1.15	5.80			22.0		3,299,350	
	1.7	3.5		2.40			1.20	9.00			6.6		3,236,700	

¹United States Census Reports

Table 4.—Louisiana's rank in volume of production among the States in crops and livestock, 1947-53

Commodity	Rank						
	1947	1948	1949	1950	1951	1952	1953
<i>Crops</i>							
Cotton lint	7	9	6	9	9	7	7
Cottonseed	8	8	6	8	9	7	7
Rice	1	1	1	2	2	2	2
Sugar cane for sugar and seed	1	1	1	1	1	1	1
Sugar cane for sirup	4	1	2	1	1	1	1
Sweet potatoes	1	1	1	1	1	1	1
Irish potatoes							
All states	38	36	36	42	42	42	37
Early commercial states	8	9	10	9	10	10	9
Corn	27	28	26	27	28	27	27
Oats	32	32	34	39	39	36	34
Soybeans for beans	20	21	20	21	22	23	22
Hay, all	45	45	43	43	45	44	43
Tung nuts	3	2	2	3	3	3	3
Cowpeas for peas	8	7	7	9	9	8	6
Velvet beans	6	6	6	6	6	6	6
Peanuts picked and threshed	13	13	13	13	13	13	13
Tobacco	20	20	21	21	20	20	19
Lespedeza seed ¹	15	15	15	16	16	..	..
<i>Livestock</i>							
Cattle and calves (pounds)	29	29	28	30	31	24	24
Hogs (pounds)	26	25	26	26	26	27	27
Sheep and lambs (pounds)	35	35	35	36	35	33	33
Chickens (pounds)	28	29	28	29	32	31	31
Turkeys (pounds)	45	46	45	45	45	45	42

¹Series discontinued in 1952.

Table 5—Rank of crops, livestock and livestock products in Louisiana, 1949-53

Commodity	Rank				
	1949	1950	1951	1952	1953
<i>Livestock and Livestock Products</i>					
Cattle and calves	3	4	3	3	3
Hogs	6	6	6	7	7
Sheep and lambs	25	26	27	26	26
Dairy products	5	5	4	5	5
Wool	26	24	22	24	27
Chickens	11	12	14	12	16
Turkeys	23	23	21	22	23
Eggs	7	8	9	9	9
<i>Crops</i>					
Cotton lint	1	1	1	1	1
Cottonseed	8	7	7	8	6
Sugar cane for sugar	4	3	5	4	4
Sugar cane sirup	16	14	16	14	15
Rice	2	2	2	2	2
Corn	18	17	17	19	20
Oats	24	25	24	23	22
Hay	19	19	19	20	19
Irish potatoes	17	20	20	21	21
Sweet potatoes	9	9	8	6	8
Soybeans	22	18	18	18	18
Tung nuts	15	22	23	17	17
Commercial Vegetables	12	11	11	10	11
<i>Fruit and Tree Nuts</i>					
Strawberries	10	10	10	11	11
Peaches	27	27	26	27	24
Orange	20	21	25	25	25
Pecans	13	15	13	15	13
<i>Other Products</i>					
Forest	14	13	12	13	12
Greenhouse, nursery	21	16	15	16	14

Table 6—Cash receipts from farm marketings, value of products consumed in farm household, and government payments 1924-53

Year	Crops		Livestock and livestock products		Cash receipts from farm marketings	Value of home consumption	Government payments	Value of home consumption	Cash receipts from farm marketings	Government payments	Cash receipts from farm marketings and Government payments	Cash receipts from farm marketings, value of home consumption, and Government payments
	Cash receipts from farm marketings	Value of home consumption	Cash receipts from farm marketings	Value of home consumption								
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Average												
1924-28	111,010	12,819	24,397	20,554	135,407	33,373					135,407	168,780
1929-33	76,479	11,171	19,300	16,594	95,779	27,765					96,773	124,338
1934-38	89,391	11,390	21,029	17,859	110,420	29,249	11,616				122,033	151,285
1939-43	111,929	12,636	37,285	21,144	149,214	33,781	17,408				166,622	200,403
Annual												
1944	174,420	16,085	63,185	27,881	237,605	43,966	17,020				254,625	298,591
1945	186,582	19,995	71,644	29,845	258,226	49,840	12,796				271,022	320,862
1946	172,732	21,652	82,725	36,447	255,457	58,099	11,795				267,252	325,351
1947	227,544	26,850	107,853	40,080	335,397	66,930	9,079				344,476	411,406
1948	246,827	21,734	107,675	42,352	354,502	64,086	8,558				363,060	427,146
1949	235,320	18,821	100,482	36,763	335,802	55,584	9,093				344,895	400,479
1950	226,952	16,117	96,552	31,425	323,504	47,542	11,437				334,941	382,483
1951	263,834	17,843	118,526	34,714	382,360	52,557	11,584				393,944	446,501
1952	319,715	15,549	117,420	33,413	437,135	48,962	9,543				446,678	495,640
1953	290,591		104,942		395,533		6,720				402,253	

¹Government payments for 1933—\$4,970,000.

Table 7—Cash receipts from farm marketings by commodities 1924-53

COMMODITY	Average 1924-28	Average 1929-33	Average 1934-38	Average 1939-43	Average 1944-48	1949	1950	1951	1952	1953
	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars
<i>Livestock and live- stock products</i>										
Cattle & calves	24,194.8	19,158.2	20,767.6	36,375.6	86,955.0	98,221	95,118	113,346	108,958	102,936
Hogs	5,911.6	5,073.2	6,827.6	11,277.4	36,139.0	38,673	37,855	51,903	43,932	42,766
Sheep & lambs	5,277.6	3,293.6	4,912.4	8,181.2	18,865.6	19,534	18,229	17,861	17,542	12,686
Dairy products	180.4	170.2	146.8	200.6	314.2	261	116	118	157	262
Wool	7,400.4	6,686.0	6,402.6	9,871.6	18,025.6	23,425	26,370	29,490	33,454	33,983
Chickens	197.4	128.6	167.6	248.2	258.8	143	155	293	170	204
Turkeys	2,055.6	1,725.2	421.8	2,539.0	5,092.6	5,683	4,055	2,725	3,325	1,807
Eggs	---	66.2	118.6	165.6	236.8	318	432	567	662	620
	3,171.8	2,015.2	1,740.2	3,892.0	8,022.4	10,184	7,906	10,389	9,716	10,608
<i>Crops</i>										
Cotton lint	104,187.8	65,889.0	39,474.6	104,500.0	176,431.6	200,491	211,435	263,270	293,167	277,357
Cottonseed	61,965.6	33,736.0	36,661.2	40,236.8	62,223.2	94,507	84,774	140,903	138,172	133,356
Sugar cane, sugar	7,492.8	4,256.2	6,834.2	7,414.2	10,323.0	10,104	11,116	16,346	18,225	16,074
Sugar cane, sirup	6,085.2	8,875.6	3,774.8	16,671.2	28,450.4	30,963	41,859	26,198	37,629	41,839
Rice	2,472.6	1,646.0	2,289.8	2,974.6	6,713.4	1,539	2,938	2,233	2,876	1,908
Corn	17,138.2	11,201.2	13,260.4	24,680.4	44,481.0	43,110	53,463	52,753	64,773	60,348
Oats	869.0	608.4	1,129.0	1,143.8	1,563.2	1,290	1,571	1,670	1,441	978
Hay	10.0	9.2	64.0	273.8	617.2	284	153	183	300	641
Irish potatoes	371.8	260.2	285.4	550.2	990.2	900	1,147	969	1,311	1,148
Sweet potatoes	1,801.0	1,282.6	1,424.0	2,126.4	2,497.6	1,444	685	641	1,161	741
Soybeans	2,387.8	1,805.8	2,400.4	4,058.4	9,573.6	9,190	6,710	15,024	17,133	12,421
Tung nuts	291.6	195.8	127.6	427.6	759.6	711	1,448	1,635	1,515	1,488
Vegetable crops	---	---	---	182.0	984.8	1,613	573	281	2,325	1,625
	2,702.2	2,012.0	2,223.8	3,751.6	6,674.4	4,836	4,998	4,434	6,336	4,790
<i>Fruits and tree nuts</i>										
Strawberries	6,254.4	6,126.0	4,806.6	6,054.2	11,301.4	10,052	9,243	7,696	6,900	11,116
Peaches	5,220.4	5,027.6	3,656.8	4,437.2	8,179.4	6,399	6,380	4,574	4,098	7,150
Oranges	111.6	108.4	155.8	204.0	383.6	134	88	119	125	369
Pecans	341.2	366.2	349.4	434.4	695.4	613	779	171	158	270
	581.2	623.8	644.6	978.6	2,043.0	2,740	2,162	2,832	2,519	3,327
<i>Other products</i>										
Forest	2,442.4	1,557.8	1,609.8	2,233.2	2,909.2	2,667	5,143	5,443	5,783	5,783
Greenhouse, nursery	1,831.6	1,141.4	1,218.8	1,725.2	2,278.6	1,935	3,069	3,096	3,339	3,339
	610.8	416.4	391.0	508.0	630.6	732	2,074	2,347	2,444	2,444
<i>Total from selected commodities</i>	137,079.4	92,731.0	107,658.6	149,163.0	277,597.2	311,431	320,039	389,755	414,808	397,192

Table 8—Cattle and calves: January 1 inventory, calf crop, and disposition, 1924-53

Year	On hand Jan. 1			Calves born		In ship-ments	Marketings ¹		Farm slaughter		Deaths	
	All cattle	All cows and over	2 yrs. and over	Number	Per cent of cows 2 yrs. and over		Cattle	Calves	Cattle	Calves	Cattle	Calves
	1,000	1,000	1,000	1,000	Per cent		1,000	1,000	1,000	1,000	1,000	1,000
					cent							
Average												
1924-28	844.0	466.2		277.8	57.4	16.8	144.8	79.6	16.6	12.2	28.0	26.4
1929-33	886.0	484.2		310.2	61.2	16.0	141.4	60.6	14.0	10.4	25.6	24.0
1934-38	21,100.4	605.6		398.6	65.8	12.4	227.0	78.0	14.2	12.2	29.0	35.0
1939-43	1,231.8	680.8		478.6	70.2	17.8	195.4	140.8	7.2	10.2	34.0	38.4
Annual												
1944	1,500	825		578	70	22	211	214	8	13	40	53
1945	1,561	894		599	67	45	337	210	7	13	39	54
1946	1,545	896		627	70	50	384	263	9	14	41	59
1947	1,452	857		583	68	33	415	302	7	13	38	44
1948	1,249	775		558	72	24	252	272	6	13	30	34
1949	1,224	745		581	78	23	185	281	5	13	22	37
1950	1,285	783		626	80	22	120	299	6	13	31	38
1951	1,426	855		650	76	16	137	318	5	13	37	42
1952	1,540	930		744	80	27	106	333	5	13	33	45
1953	1,771	349		839	79	17	256	433	5	16	31	41

¹Excludes interfarm sales.

²Includes government purchases in 1934 and 1935.

Table 9.—Cattle and calves: Production, marketings, price, and income, 1924-53

Year	Pro- duction pounds	Market- ings ¹ pounds	Average price per 100 pounds		Cash receipts dollars	Value of home con- sumption dollars	Gross income dollars	Cost of in- shipments dollars
			Cattle	Calves				
Average	1,000	1,000	Dollars	Dollars	1,000	1,000	1,000	1,000
1924-28	98,845.0	98,024.0	5.41	6.94	5,911.6	241.0	6,152.6	366.2
1929-33	117,351.0	93,324.0	4.92	6.47	5,073.2	188.6	5,261.8	234.4
1934-38 ²	154,983.0	146,710.0	4.36	5.36	6,827.6	173.0	7,000.6	192.0
1939-43	176,406.0	147,265.0	7.22	8.92	11,277.4	184.6	11,462.0	572.0
Annual								
1944	197,535	165,270	9.20	11.20	16,685	299	16,984	1,044
1945	224,280	252,040	10.30	12.20	27,426	314	27,740	2,409
1946	249,270	304,295	12.00	14.80	39,001	433	39,434	3,282
1947	236,280	325,960	14.50	18.40	50,911	457	51,368	2,888
1948	202,135	229,480	18.60	22.90	46,672	573	47,245	2,727
1949	217,510	196,720	17.70	21.40	38,673	506	39,729	2,208
1950	218,620	165,260	19.70	24.50	37,855	658	38,513	2,614
1951	241,915	192,490	23.60	29.10	51,903	691	52,594	2,408
1952	273,805	192,180	20.30	23.60	44,932	610	44,542	3,261
1953	361,570	325,045	11.00	15.20	42,766	430	43,196	1,366

¹Excludes interfarm sales.²Includes Government purchases.

Table 10.—Cattle: Numbers on farms, value per head, and farm value, January 1, 1909-54

Year	Number		Value per head				Farm value		
	Dairy ¹	Other	All	Dairy	Other	All	Dairy	Other	All
	1,000	1,000	1,000	Dollars	Dollars	Dollars	1,000 Dollars	1,000 Dollars	1,000 Dollars
Average									
1909-13	239.8	525.8	765.6	27.16	11.02	16.08	6,536.2	5,789.0	12,325.2
1914-18	242.4	647.6	890.0	39.70	18.54	24.26	9,583.8	12,219.2	21,803.0
1919-23	228.0	720.0	948.0	48.00	20.94	27.42	1,086.2	15,372.6	26,235.0
1924-28	250.4	593.6	844.0	33.60	14.41	20.10	8,419.0	4,498.8	16,917.8
1929-33	262.0	624.0	886.0	36.60	17.67	23.32	9,475.8	10,759.8	20,235.6
1934-38	311.2	789.2	1,100.4	28.00	12.81	17.12	8,700.0	10,110.0	18,850.0
1939-43	339.4	892.4	1,231.8	43.40	22.76	28.42	14,825.8	20,624.0	35,499.8
Annual									
1944	367	1,133	1,500	68.00	34.24	42.50	24,956	38,794	63,750
1945	379	1,182	1,561	68.00	33.27	41.70	25,772	39,322	65,094
1946	368	1,177	1,545	72.00	37.50	45.70	26,496	44,138	70,606
1947	353	1,099	1,452	85.00	45.90	55.40	30,005	66,033	80,441
1948	325	924	1,249	100.00	57.62	68.50	32,500	53,241	85,556
1949	299	925	1,224	122.00	72.48	84.30	36,478	67,044	103,183
1950	308	977	1,285	128.00	73.84	86.30	39,424	84,315	110,896
1951	320	938	1,426	160.00	102.64	117.00	51,200	126,355	166,842
1952	326	1,040	1,540	175.00	123.60	127.00	57,050	128,530	195,580
1953	349	1,422	1,771	150.00	85.24	98.00	52,350	121,208	173,558
1954	366	1,476	1,842	100.00	48.83	59.00	36,600	72,078	108,678

¹Cows and heifers 2 years and over kept for milk.

Table 11.—Cattle: Number on farms, by classes, 1920-54

Year	All Cattle	Milk animals				Other animals			
		Cows 2 years and over	Heifers 1-2 yrs.	Heifer calves	Cows 2 years and over	Heifers 1-2 yrs.	Other calves	Steers 1 year and over	Bulls 1 year and over
Average	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1920-24	915.8	233.6	48.0	55.6	262.8	68.0	164.4	62.2	17.2
1925-29	831.0	251.4	44.0	61.0	230.8	55.0	126.4	46.2	16.2
1930-34	936.2	271.0	58.2	70.0	254.2	62.8	148.6	51.4	20.0
1935-39	1,116.0	317.4	72.2	91.2	294.8	86.2	182.4	49.0	22.8
1940-44	1,302.2	347.0	91.4	106.2	375.8	128.0	188.4	51.2	25.6
Annual									
1945	1,561	379	97	114	515	141	203	78	34
1946	1,545	368	96	106	528	131	216	68	32
1947	1,452	353	89	96	504	128	195	57	30
1948	1,249	325	80	84	450	106	140	39	25
1949	1,224	299	70	83	446	107	156	39	24
1950	1,285	308	69	85	475	116	165	81	26
1951	1,426	320	73	95	535	151	181	45	26
1952	1,540	326	83	91	604	170	186	49	31
1953	1,771	349	75	95	713	190	258	56	35
1954	1,842	366	82	100	746	200	246	61	38

Table 12.—Dairy products: Production, disposition, and income, 1924-53

Year	Number of milk cows on farms ¹	Milk produced per cow	Total production on farms			Total milk used on farms ²	Total milk utilized for products sold	Cash receipts ³	Value of home consumption ⁴	Gross income from dairy products
			Milk		Butter					
			Million pounds	Million pounds	1,000 pounds	Million pounds	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Average										
1924-28	206.4	2 286	472.4	20.6	4 944.0	279.4	193.0	7 400.4	10 511.2	17 911.6
1929-33	235.2	2 364	555.4	24.4	6 393.7	319.8	235.6	6 686.0	8 800.6	15 486.6
1934-38	268.8	2 236	601.0	26.2	6 561.8	332.0	249.0	6 402.6	8 889.4	15 292.0
1939-43	286.4	2 296	657.8	29.4	5 992.0	341.0	316.8	9 871.6	10 148.8	20 020.4
Annual										
1944	296	2 350	696	31	4 900	326	370	15 159	13 079	28 238
1945	296	2 340	693	31	5 700	339	354	14 781	13 836	28 617
1946	290	2 300	667	30	5 500	339	328	17 087	17 297	34 384
1947	278	2 390	679	31	5 200	315	349	21 085	18 603	39 688
1948	260	2 500	695	31	5 000	320	330	22 016	20 877	42 893
1949	258	2 600	720	32	4 800	288	383	23 425	17 197	40 622
1950	282	2 550	719	32	4 600	275	444	26 370	15 800	42 170
1951	296	2 470	731	32	4 300	273	458	29 490	16 937	46 427
1952	307	2 500	768	34	4 200	281	487	33 454	18 618	52 072
1953	325	2 480	806	35	4 200	286	520	33 983	17 985	51 968

¹Average number on farms during year. Heifers not freshened excluded.

²Includes milk used as milk or cream and as farm butter, and milk fed to calves.

³Value of combined sales of butter, cream, and milk.

⁴Milk and milk equivalent of cream and farm butter consumed, valued at the average returns for milk utilized in dairy products sold. Does not include milk fed to calves.

Table 13—Dairy products: Farm marketings, price, and value, 1924-53

Year	Farm butter sold ¹			Butterfat sold to plants and dealers			Whole-sale milk sold to plants and dealers			Milk and cream retailed by farmers		
	Quantity	Price per lb.	Value of sales	Quantity	Price per lb.	Value of sales	Quantity	Price per lb.	Value of sales	Quantity	Price per lb.	Value of sales
	1,000 pounds	Cents	1,000 dollars	1,000 pounds	Cents	1,000 dollars	1,000 pounds	Cents	1,000 dollars	1,000 pounds	Cents	1,000 dollars
Average												
1924-28	610.0	43.8	266.8	424.0	40.0	170.6	103.2	2.79	2,872.0	31.6	12.94	4,091.0
1929-33	662.6	31.8	209.4	124.0	26.4	297.4	123.6	2.07	2,594.8	32.2	11.12	3,584.4
1934-38	612.0	27.6	169.0	136.8	24.4	333.2	133.4	2.03	2,719.0	32.4	9.82	3,181.4
1939-43	477.0	32.8	151.2	142.6	30.2	420.8	203.2	2.70	5,697.4	32.8	10.98	3,602.2
Annual												
1944	400	45	180	630	45	284	274	3.75	10,275	34	13.0	4,420
1945	500	48	240	590	47	277	259	3.80	9,972	33	13.4	4,422
1946	500	59	295	340	54	184	245	4.93	12,078	30	15.1	4,530
1947	450	64	288	340	62	211	267	5.71	16,274	30	17.8	5,340
1948	400	66	264	210	66	139	254	6.26	20,345	29	19.7	5,713
1949	400	61	244	130	59	77	370	5.75	21,275	24	19.6	4,704
1950	350	58	203	80	57	46	390	5.61	21,879	21	20.2	4,242
1951	300	61	183	80	60	48	410	6.14	25,174	19	21.5	4,085
1952				80	52	50	455	6.55	29,148	19	22.4	4,256
1953				80	59	47	480	6.23	29,904	18	22.4	4,032

¹Series on butter discontinued in 1952.

Table 14.—Hogs and pigs: Number on farms, value per head, and farm value, January 1, 1909-54

Year	Number	Value per head	Farm Value dollars
	1,000	Dollars	1,000
Average			
1909-13	1,056.2	5.85	6,195.8
1914-18	975.0	9.16	8,990.6
1919-23	783.2	11.70	9,476.2
1924-28	520.6	8.90	4,609.0
1929-33	676.4	7.28	4,779.2
1934-38	791.0	5.97	4,711.2
1939-43	880.8	7.22	6,221.6
Annual			
1944	1,049	11.10	11,579
1945	902	11.40	10,238
1946	812	14.60	11,855
1947	739	17.50	12,932
1948	724	21.70	15,711
1949	717	21.00	15,057
1950	703	16.00	11,248
1951	619	18.70	11,575
1952	551	18.70	10,304
1953	463	15.30	7,084
1954	380	20.60	7,828

Table 15—Hogs: January 1 inventory, pig crop, and disposition, 1921-53

Year	On hand Jan- uary 1	Spring		Fall		In ship- ments	Mar- ket- ings	Farm slaughter	Deaths
		Sows farrowed	Pigs saved	Sows farrowed	Pigs saved				
Average	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1924-28	520.6	87.2	434.6	53.6	277.6	3.6	288.2	320.2	106.2
1929-33	676.4	88.4	462.4	63.6	343.0	3.0	243.8	358.2	109.0
1934-38	791.0	124.8	623.2	95.0	478.2	2.8	440.2	439.0	197.4
1939-43	880.8	127.8	639.2	104.0	536.0	9.2	493.2	412.0	256.2
Annual									
1944	1,049	146	774	95	494	13	738	390	300
1945	902	124	632	97	524	1	622	375	250
1946	812	118	614	86	430	3	500	385	235
1947	739	101	525	89	472	1	498	330	185
1948	724	94	489	85	459	2	487	310	160
1949	717	97	514	87	470	1	529	290	180
1950	703	85	476	71	419	8	517	270	200
1951	619	73	409	66	376	8	436	250	175
1952	551	73	438	55	319	8	500	195	158
1953	463	51	291	42	248	4	321	180	125

Table 16—Hogs: Production, marketing, price, and income, 1924-53

Year	Volume		Season average price per 100 lbs.	Cash receipts 1,000 dollars	Value of home consumption 1,000 dollars	Gross income 1,000 dollars	Cost of inship- ments 1,000 dollars
	Production, cwt.	Sold, cwt.					
Average	1,000	1,000	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	
1924-28	994.7	487.4	8.54	5,277.6	3,546.0	8,823.6	44.2
1929-33	1,067.7	448.8	5.90	3,293.2	2,583.2	5,876.8	36.4
1934-38	1,412.1	684.3	5.76	4,942.6	3,235.6	8,178.0	31.8
1939-43	1,532.6	860.6	7.92	8,181.2	4,127.2	12,308.4	144.0
Annual							
1944	1,778.6	1,322.4	10.40	15,440	5,192	20,632	232
1945	1,637.4	1,142.5	12.30	16,092	6,273	22,365	21
1946	1,542.6	938.9	15.20	16,935	8,193	25,158	75
1947	1,498.6	969.4	20.70	23,175	9,563	32,738	33
1948	1,467.0	934.1	21.10	22,686	9,158	31,844	68
1949	1,450.8	988.1	17.50	19,534	6,902	26,436	28
1950	1,323.7	982.3	16.60	18,229	5,916	24,145	217
1951	1,172.8	847.8	18.70	17,861	6,171	24,032	242
1952	1,142.9	944.7	17.10	17,542	4,268	21,810	223
1953	787.4	587.0	19.10	12,686	4,538	17,224	124

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Table 17.—Sheep and lambs: Number on farms, value per head, and farm value, January 1, 1909-54

Year	Number	Value per head	Farm Value
	1,000	Dollars	1,000 dollars
Average			
1909-13	186.2	1.90	354.0
1914-18	209.8	2.74	581.8
1919-23	227.6	4.02	916.0
1924-28	237.0	3.06	725.0
1929-33	255.0	2.82	715.6
1934-38	264.2	2.84	748.6
1939-43	278.6	3.51	977.4
Annual			
1944	231	4.40	1,016
1945	226	4.45	1,006
1946	217	4.45	966
1947	176	5.60	986
1948	143	5.60	801
1949	167	6.60	706
1950	98	7.90	774
1951	104	9.50	988
1952	109	11.80	1,286
1953	122	10.60	1,293
1954	122	8.70	1,061

Table 18.—Sheep and lambs: January 1 inventory, lamb crop, and disposition, 1924-53

Year	On hand Jan. 1	Lambs	In- shipments		Marketings ¹		Farm slaughter		Deaths	
	All-sheep and lambs	saved	Sheep	Lambs	Sheep	Lambs	Sheep	Lambs	Sheep	Lambs
	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Average										
1924-28	237.0	71.4	1.00	--	19.4	18.4	1.20	1.40	20.0	10.0
1929-33	255.0	86.0	.60	--	19.2	28.8	1.00	2.60	20.0	10.0
1934-38	264.2	92.0	.20	--	21.6	24.8	2.60	4.40	25.6	12.0
1939	278.6	92.6	--	.20	25.8	21.4	2.00	3.00	34.2	15.4
Annual										
1944	231	72	--	--	22	8	2	3	28	14
1945	226	76	--	--	18	14	2	3	33	15
1946	217	69	--	--	44	10	2	3	30	17
1947	176	58	--	--	34	16	2	3	25	11
1948	143	52	--	--	38	13	2	3	20	12
1949	107	43	4	1	15	11	2	2	14	8
1950	98	40	--	2	4	5	2	2	13	10
1951	104	38	--	--	6	1	2	2	13	10
1952	109	48	1	1	2	8	2	2	14	8
1953	122	50	--	--	9	16	2	2	14	7

¹Excludes interfarm sales.

Table 19.—Sheep and lambs: Production, marketings, price, and income, 1924-53

Year	Production	Marketings ¹	Price per cwt.		Cash receipts	Value of home consumption	Gross income	Cost of in-shipments
			Sheep	Lambs				
	1,000 pounds	1,000 pounds	Dollars	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Average								
1924-28	2,902.0	2,666.0	5.88	7.70	180.4	6.8	187.2	5.80
1929-33	3,818.6	3,225.6	4.63	6.23	170.2	6.0	176.2	2.00
1934-38	3,789.0	3,261.2	3.64	5.13	146.8	11.2	158.0	.60
1939-43	3,146.6	3,580.6	4.72	6.56	200.6	10.6	211.2	.80
Annual								
1944	2,508	2,608	6.20	8.40	187	14	201	..
1945	2,134	2,514	6.50	9.70	202	15	217	-
1946	1,760	4,880	6.90	11.00	377	16	393	..
1947	1,510	3,980	7.10	13.60	354	18	372	..
1948	1,577	4,347	8.80	15.00	451	22	473	..
1949	1,630	2,140	9.00	16.30	261	18	279	53
1950	1,298	708	10.30	17.20	116	21	137	35
1951	1,298	658	12.60	23.60	118	27	145	19
1952	1,914	694	10.60	22.40	157	24	181	9
1953	2,312	1,862	8.30	17.30	262	18	280	..

¹Excludes interfarm sales.

Table 20.—Wool: Production, price, and value, 1909-53

Year	Sheep shorn	Weight per fleece	Production	Season-average price per pound	Farm value
	1,000	Pounds	1,000 pounds	Cents	1,000 dollars
Average					
1909-13	152.8	3.56	541.0	17.8	95.0
1914-18	172.0	3.73	642.4	25.8	168.4
1919-23	186.8	3.18	594.4	22.4	135.0
1924-28	198.8	3.24	644.2	30.6	197.4
1929-33	209.6	3.46	725.8	18.2	128.6
1934-38	220.8	3.34	737.0	22.8	167.6
1939-43	238.8	3.28	783.4	31.8	248.2
Annual					
1944	196	3.2	627	48	301
1945	192	3.3	634	48	304
1946	184	3.2	589	48	283
1947	150	3.4	510	43	219
1948	122	3.4	415	45	187
1949	91	3.5	318	45	143
1950	83	3.4	282	55	155
1951	88	3.2	282	104	293
1952	93	3.5	326	52	170
1953	104	3.5	364	56	204

Table 21.—Workstock: Number on farms, value per head, and total value, 1910-54

Year	Horses			Mules		
	Number	Value per head	Farm value	Number	Value per head	Farm value
	1,000	Dollars	1,000 dollars	1,000 head	Dollars	1,000 dollars
Average						
1910-14	172.8	82.6	14,268.4	131.4	121.2	16,298.4
1915-19	188.6	88.2	16,676.8	163.0	106.0	21,359.0
1920-24	161.8	82.0	13,465.0	181.0	127.2	23,068.0
1925-29	135.8	54.2	7,376.0	185.0	86.6	18,973.2
1930-34	124.6	41.6	5,189.6	200.6	69.9	13,960.0
1935-39	124.4	58.0	7,346.8	196.2	103.4	20,263.0
1940-44	146.0	64.2	9,367.8	176.2	112.6	19,795.8
Annual						
1945	145	71	10,295	161	122	19,642
1946	139	71	9,869	148	116	17,168
1947	135	68	9,180	142	117	16,614
1948	128	68	8,704	136	111	15,096
1949	123	52	6,396	126	89	11,214
1950	121	47	5,687	115	79	9,085
1951	120	34	4,080	109	56	6,104
1952	109	31	3,379	100	50	5,000
1953	101	30	3,030	92	44	4,048
1954	96	30	2,880	82	43	3,526

Table 22.—All chickens: Number on farms, value per head, and farm value, January 1, 1924-54

Year	Number	Value per head		Farm Value
	1,000		Dollars	1,000 dollars
Average				
1924-28	4,606.6		.746	3,280.4
1929-33	5,001.6		.648	3,280.4
1934-38	4,683.4		.514	2,412.4
1939-43	5,776.0		.672	3,965.8
Annual				
1944	7,259		1.15	8,348
1945	6,152		1.21	7,444
1946	6,248		1.31	8,185
1947	5,514		1.45	7,995
1948	5,056		1.45	7,331
1949	5,244		1.55	8,128
1950	5,195		1.40	7,273
1951	4,986		1.45	7,230
1952	4,990		1.50	7,485
1953	4,577		1.40	6,408
1954	4,276		1.40	5,986

Table 23—All chickens: January 1 inventory, production, disposition, price, and income, 1924-53

Year	All chickens on farms	Number			Consumed on farms	Sold	Produced	Consumed on farm	Sold	Price ²		Cash receipts dollars	Value of home con- sumption dollars	Gross income dollars
		Raised	Lost	Produced ¹						Per pound	Per head			
Average	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	Cents	Cents	1,000	1,000	1,000
1924-28	4,606.6	7,135.2	618.0	6,517.2	3,872.0	2,546.8	21,759.6	12,390.4	9,027.8	22.74	80.4	2,055.6	2,818.8	4,874.4
1929-33	5,001.6	7,870.0	738.8	7,131.2	4,476.6	2,705.4	24,173.4	14,412.8	9,745.8	16.78	60.4	1,725.2	2,359.8	4,085.0
1934-38	4,683.4	7,491.4	693.6	6,797.8	5,918.6	770.0	22,954.6	19,644.0 ^a	2,903.6	14.36	55.6	421.8	2,823.8	3,247.2
1939-43	5,778.0	9,775.6	921.0	8,854.6	5,227.0	3,203.6	31,264.2	17,862.8	11,821.4	19.62	67.2	2,539.0	3,502.0	6,041.0
Annual														
1944	7,259	9,889	1,307	8,582	4,392	5,297	33,010	16,250	21,188	28.4	115	6,017	4,615	10,632
1945	6,152	9,889	1,046	8,843	4,495	4,252	32,719	16,632	15,732	31.7	121	4,987	5,272	10,259
1946	6,248	8,900	1,125	7,775	4,643	3,866	29,581	17,179	14,691	34.3	131	5,039	5,892	10,931
1947	5,514	8,455	937	7,518	4,337	3,639	27,382	15,613	13,464	36.0	145	4,847	5,621	10,468
1948	5,056	8,624	860	7,764	4,264	3,312	28,650	15,350	12,586	37.0	145	4,657	5,680	10,337
1949	5,244	9,486	944	8,542	4,318	4,273	32,028	15,977	16,237	35.0	155	5,683	5,592	11,215
1950	5,195	8,253	1,039	7,214	4,663	2,760	27,457	8,752	12,515	28.6	140	3,091	6,076	9,167
1951	4,986	8,005	997	7,008	4,663	2,341	26,167	16,787	9,364	29.1	145	2,725	4,825	7,610
1952	4,990	8,005	1,098	6,907	4,430	2,890	25,608	15,948	11,271	29.5	150	3,325	4,705	8,030
1953	4,577	6,484	1,098	5,386	4,253	1,434	18,907	14,035	6,166	29.3	140	1,807	4,112	5,919

¹Chickens sold plus consumed in household of farm producers, and change in inventory.

²Prior to 1940 price per head used to compute values.

³No weights per bird consumed prior to 1936.

Table 24—Chicks hatched in commercial hatcheries, Louisiana 1938-53

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand	Thou- sand
1938	121	304	430	333	250	73	71	106	102	100	87	106	2,083
1939	146	374	526	412	307	90	87	131	123	123	110	131	2,560
1940	159	225	460	421	324	133	69	74	108	108	106	113	2,300
1941	192	346	676	683	536	315	98	98	136	136	144	140	3,500
1942	230	515	817	801	780	617	219	178	219	265	255	204	5,100
1943	671	971	1,272	1,206	1,186	671	425	153	207	294	271	219	7,546
1944	418	938	1,286	1,157	809	204	27	43	102	112	144	118	5,358
1945	305	780	1,008	1,041	758	453	196	125	136	196	240	213	5,451
1946	404	842	1,076	1,141	553	35	35	85	145	214	269	184	4,983
1947	367	724	1,066	1,132	612	260	128	92	117	250	255	97	5,100
1938	198	599	1,056	1,132	639	274	178	127	188	218	289	178	5,076
1949	327	792	1,186	1,125	843	402	152	134	217	339	384	117	6,018
1950	397	817	1,347	1,123	594	293	128	197	336	549	447	230	6,458
1951	463	836	1,088	1,229	856	370	216	258	307	626	586	400	7,235
1952	661	1,106	1,371	1,196	665	370	201	265	496	738	598	508	8,175
1953	608	868	1,190	1,071	633	423	297	402	572	652	742	742	8,200

Table 25.—Commercial Broilers: Production, price, and value, 1934-53

Year	Production		Price per pound	Gross income	Total sale of chickens and commercial broilers		
	Number	Volume			Thousand lbs. sold	Price per lb.	Value of sale
	1,000	1,000 pounds	Cents	1,000 dollars	1,000	Cents	1,000 dollars
1934	250	575	18.5	106	2,016	12.2	246
1935	300	690	19.0	131	2,116	14.6	309
1936	350	805	18.1	146	2,858	16.3	466
1937	400	960	21.5	206	4,936	15.5	766
1938	450	1,080	18.6	201	2,592	15.5	402
1939	500	1,100	17.0	187	6,678	15.3	1,020
1940	600	1,380	18.0	248	10,084	15.4	1,553
1941	700	1,610	19.5	314	10,434	17.6	1,836
1942	1,100	2,420	26.0	629	11,594	22.1	2,562
1943	1,540	3,234	31.0	1,003	20,317	28.9	5,872
1944	1,232	3,203	33.0	1,057	21,188	28.4	6,017
1945	1,540	3,542	35.0	1,240	19,274	32.3	6,227
1946	1,309	3,011	39.0	1,174	17,702	35.1	6,213
1947	1,244	3,234	41.0	1,326	16,698	37.0	6,173
1948	1,493	3,732	43.0	1,605	16,318	38.4	6,262
1949	1,866	5,038	36.0	1,814	21,275	35.2	7,479
1950	2,146	5,794	30.2	1,750	16,832	28.8	4,841
1951	4,507	12,620	31.0	3,912	21,984	30.2	6,637
1952	8,113	22,716	29.5	6,701	33,987	29.5	10,026
1953	12,575	33,952	27.0	9,167	40,119	27.4	10 974

Table 26.—Turkeys: Number on farms, value per head, and farm value, January 1, 1929-54

Year	Number	Value per head	Farm Value
	1,000		1,000 dollars
Average		Dollars	
1929-33	26.0	2.99	72.2
1934-38	36.0	2.21	80.4
1939-43	31.4	2.84	86.2
Annual			
1944	22	5.10	112
1945	18	5.30	95
1946	18	6.00	108
1947	17	6.20	105
1948	19	6.50	124
1949	16	7.40	118
1950	17	6.20	105
1951	18	6.10	110
1952	21	6.20	130
1953	21	6.00	126
1954	20	5.80	116

Table 27—Turkeys: January 1 inventory, production, disposition, price, and income, 1929-53

Year	All turkeys on farms	Number raised	Number lost	Number produced	Number consumed on farms	Number sold	Produced on farms	Consumed on farms	Sold	Price		Cash receipts	Value of home income consumption	
										per pound	Dollars		1,000 dollars	1,000 dollars
Average	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	Cents	Dollars	1,000 dollars	1,000 dollars	1,000 dollars
1929-33	26.0	49.4	2.8	46.6	17.6	24.4	595.0	185.2	376.8	19.78	2.830	66.2	36.2	102.4
1934-38	36.0	63.2	4.0	59.2	13.8	45.8	804.0	187.0	621.8	19.12	2.506	118.6	35.8	154.4
1939-43	31.4	58.0	3.4	54.6	9.8	46.8	772.6	138.2	663.2	24.92	2.844	165.6	32.4	198.0
Annual														
1944	22	46	3	43	8	39	624	116	566	37.5	5.10	212	44	256
1945	18	51	3	48	11	37	729	167	562	39.4	5.30	221	66	287
1946	18	51	4	47	15	33	720	230	505	42.2	6.00	213	97	310
1947	17	56	2	54	14	38	815	211	574	45.7	6.20	262	96	338
1948	19	53	2	51	19	35	790	294	542	50.9	6.50	276	150	426
1949	16	71	2	69	23	45	1,104	368	720	44.1	7.40	318	162	480
1950	17	85	2	85	17	65	1,229	252	962	44.9	6.20	432	113	545
1951	18	106	2	104	20	81	1,560	300	1,215	46.7	6.10	567	140	707
1952	21	122	1	121	17	104	1,718	241	1,477	44.8	6.20	662	108	770
1953	21	122	1	111	20	92	1,865	336	1,546	40.1	6.00	620	135	755

Table 28—Eggs: Production, disposition, price, and value, 1924-53

Year	Produced 1,000 doz.	Number consumed on farms 1,000 doz.	Sold 1,000 doz.	Season average price per doz. Cents	Value of		
					home con- sumption 1,000 dollars	Sales 1,000 dollars	Value of production ¹ 1,000 dollars
Average							
1924-28	23,450.0	10,733.3	11,533.3	27.5	2,949.0	3,171.8	6,445.6
1929-33	22,283.3	11,400.0	9,666.7	19.6	2,213.6	2,015.2	4,470.2
1934-38	21,066.7	11,133.3	8,933.3	19.4	2,133.4	1,740.2	4,087.4
1939-43	27,283.3	10,816.7	15,500.0	23.6	2,535.8	3,892.0	6,660.4
Annual							
1944	34,500	10,417	23,083	31.7	3,302	7,317	10,937
1945	32,500	10,250	21,250	36.7	3,762	7,799	11,561
1946	29,583	10,333	18,500	39.0	4,030	7,215	11,245
1947	28,250	10,167	17,500	46.3	4,707	8,102	12,809
1948	30,500	9,583	20,333	47.6	4,562	9,679	14,241
1949	32,917	10,000	22,333	45.6	4,560	10,184	14,744
1950	31,583	10,833	20,750	38.1	3,937	7,906	11,843
1951	31,500	9,750	21,333	48.7	4,748	10,389	15,137
1952	32,083	9,833	21,833	44.5	4,376	7,916	14,092
1953	31,833	9,667	21,917	48.4	4,679	10,608	15,407

¹Gross income plus value of eggs used for farm hatching.

Table 29.—Honey Bees: Number of colonies, production, price, and value of honey and beeswax, 1939-53

Year	Colonies of bees	Production		Season average price		Value of production	
		Honey	Beeswax	All honey	Beeswax	Honey	Beeswax
	1,000	1,000 pounds	1,000 pounds	Cents per pound	Cents per pound	1,000 dollars	1,000 dollars
1939	57	1,254	--	--	--	--	--
1940	60	1,020	--	--	--	--	--
1941	52	1,300	24	--	29.0	--	--
1942	56	1,008	19	10.5	40.3	106	8
1943	62	1,860	32	13.4	42.8	249	14
1944	68	1,564	42	16.0	42.0	250	18
1945	75	1,575	39	16.8	40.0	265	16
1946	81	1,215	30	17.5	46.0	213	14
1947	87	1,914	42	16.8	45.0	322	19
1948	96	1,920	40	13.1	44.0	252	18
1949	101	2,020	32	13.2	40.0	267	13
1950	96	1,920	38	12.9	43.0	248	16
1951	95	2,375	45	13.3	50.0	316	22
1952	95	2,375	45	14.6	43.0	347	19
1953	100	2,200	37	15.5	40.0	341	15

Table 30.—Package bees: Colonies for production of package bees, package bees shipped, and queen bees shipped, 1944-51¹

Year	Colonies held for production of package bees	Total pounds of package bees shipped	Queen bees shipped
	Number	Pounds	Number
1944	-	178,000	177,000
1945	27,600	196,000	170,800
1946	31,700	206,000	170,000
1947	33,300	243,000	188,700
1948	33,300	216,000	141,500
1949	30,000	136,000	134,400
1950	29,000	122,400	127,700
1951	29,000	128,500	128,500

¹This series discontinued in 1952.

Table 31—Cotton lint: Acreage, yield, production, price, and value, 1909-53

Year	Acreage		Yield per acre	Volume		Season average price per pound	Farm value 1,000 dollars	Income from sales 1,000 dollars
	In culti- vation, July 1	Harvested		Production, 500 lb. bales ¹	Sold, 500 lb. bales ¹			
	1,000 acres	1,000 acres	Pounds	1,000	1,000	Cents	1,000 dollars	1,000 dollars
Average								
1909-13	997.4	955.6	169.2	340.8	340.8	12.124	20,241.2	20,241.2
1914-18	1,205.0	1,191.2	196.2	492.0	492.0	18.066	48,248.8	48,248.8
1919-23	1,223.0	1,168.6	137.8	335.2	335.2	23.726	39,497.6	39,497.6
1924-28	1,680.2	1,680.0	199.6	694.2	694.2	18.302	61,965.6	61,965.6
1929-33	1,848.0	1,739.0	192.0	702.4	697.6	9.666	33,980.0	33,736.0
1934-38	1,320.6	1,309.2	258.2	716.4	716.4	10.564	36,661.2	36,661.2
1939-43	1,087.8	1,049.4	261.6	569.2	550.2	14.842	42,067.4	40,236.8
Annual								
1944	891	850	305	620	589	20.78	64,387	61,197
1945	819	750	258	387	387	22.60	43,698	43,698
1946	833	700	166	247	247	33.16	40,949	40,949
1947	858	770	328	505	450	32.43	81,782	72,968
1948	957	890	408	726	591	31.24	118,013	92,314
1949	1,077	950	329	625	644	29.35	95,458	94,507
1950	754	715	287	426	426	39.80	84,774	84,774
1951	949	935	391	760	760	37.10	140,903	140,903
1952	899	890	408	756	756	36.56	138,172	138,172
1953	967	950	419	806	806	33.10	133,356	133,356

¹Gross weight.

Table 32—Cottonseed: Acreage, yield, production, price, and value, 1909-53

Year	Acreage		Yield per acre	Volume		Season average price per ton	Farm value 1,000 dollars	Income from sales 1,000 dollars
	In cultiva- tion, July 1	Harvested		Production	Sold			
	1,000 acres	1,000 acres	Pounds	1,000 tons	1,000 tons	Dollars	1,000 dollars	1,000 dollars
Average								
1909-13	997.4	955.6	314.4	151.2	108.0	20.780	3,050.0	2,175.6
1914-18	1,205.0	1,191.2	304.4	218.4	184.6	42.196	9,956.4	8,504.8
1919-23	1,223.0	1,168.2	256.0	148.6	106.0	37.882	5,551.6	3,973.8
1924-28	1,680.2	1,648.0	374.8	312.0	258.4	29.528	9,072.0	7,492.8
1929-33	1,848.0	1,739.0	374.2	327.0	257.0	16.172	5,399.2	4,256.2
1934-38	1,320.6	1,309.2	469.6	311.4	261.0	27.054	8,161.2	6,834.2
1939-43	1,087.8	1,049.4	448.4	234.4	204.6	36.628	8,475.0	7,414.2
Annual								
1944	891	850	566	250	225	50.20	12,550	11,295
1945	819	750	405	163	134	49.80	8,117	6,673
1946	833	700	258	103	85	61.90	6,376	5,262
1947	858	770	473	201	170	79.80	16,040	13,566
1948	957	890	656	302	267	66.70	20,143	17,809
1949	1,077	950	503	264	240	42.10	11,114	10,104
1950	754	715	482	169	140	79.40	13,974	11,116
1951	949	935	672	308	255	64.10	19,743	16,346
1952	899	890	674	297	297	67.50	20,048	18,225
1953	967	950	697	332	332	52.70	17,496	16,074

Table 33—Rice: Acreage, yield, production, price, and value, 1909-53

Year	Acreage 1,000 acres	Yield per acre	Volume		Season average price per bushel	Farm value 1,000 dollars	Income from sales 1,000 dollars
			Production 1,000 bushels	Sold 1,000 bushels			
Average		Bushels			Dollars		
1909-13	349.0	34.42	12,008.8	10,601.2	.790	9,420.6	8,308.4
1914-18	438.0	36.10	15,702.6	13,982.6	1.254	20,247.4	18,015.6
1919-23	559.4	34.80	19,542.2	17,737.2	1.324	25,800.6	23,304.8
1924-28	470.2	35.68	16,823.4	15,220.8	1.156	18,988.0	17,138.4
1929-33	444.8	39.00	17,319.6	15,739.8	.700	12,318.8	11,201.2
1934-38	463.4	41.68	19,513.2	17,599.8	.754	14,550.2	13,260.4
1939-43	543.2	39.10	21,115.6	19,162.8	1.270	27,204.0	24,689.4
Annual							
1944	561	38.0	21,318	19,331	1.79	38,159	34,602
1945	584	39.5	23,028	20,986	1.83	42,141	38,404
1946	589	38.5	22,676	20,769	2.31	52,382	47,976
1947	613	36.0	22,008	20,024	2.20	61,748	51,662
1948	631	39.5	24,924	22,722	2.19	54,584	49,761
1949	593	40.6	23,960	21,922	1.97	47,225	43,110
1950	551	43.8	24,182	23,433	2.28	55,172	53,463
1951	612	43.3	26,493	25,644	2.05	54,300	52,753
1952	581	46.1	26,791	26,029	2.485	66,609	64,773
1953	593	45.6	27,013	26,296	2.295	61,995	60,348

Table 34—Sugar cane (sugar and seed): Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per ton ¹	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Tons	1,000 tons	1,000 tons	Dollars	1,000 dollars	1,000 dollars
Average							
1909-13	302.8	15.80	4,850.2	4,307.8	3.734	18,274.8	16,266.0
1914-18	259.0	15.60	4,066.6	3,454.4	5.594	23,468.8	20,029.8
1919-23	266.6	13.86	3,724.0	2,944.4	7.262	24,259.8	18,969.8
1924-28	176.6	11.18	2,944.4	1,511.6	4.604	8,555.6	6,685.2
1929-33	204.6	14.14	2,891.0	2,639.0	3.358	9,717.4	8,875.6
1934-38	266.2	18.88	5,050.8	4,615.4	2.958	15,067.6	13,774.8
1939-43	264.4	18.36	4,869.0	4,402.0	3.698	18,377.8	16,671.2
Annual							
1944	266	20.0	5,329	4,929	4.98	26,538	24,546
1945	253	22.3	5,633	5,209	5.58	31,432	29,066
1946	278	17.6	4,889	4,484	6.54	31,974	29,370
1947	286	15.1	4,325	3,917	7.24	31,313	28,359
1948	278	19.2	5,718	5,257	5.88	33,622	30,911
1949	301	17.9	5,378	4,984	6.20	33,344	30,901
1950	295	19.5	5,741	5,312	7.88	45,239	41,859
1951	279	17.3	4,826	4,463	5.87	28,329	26,198
1952	295	20.6	6,079	5,667	6.64	40,365	37,629
1953	301	21.5	6,472	6,020	6.95	44,980	41,839

¹Does not include benefit payments.

Table 35.—Sugar cane (for sugar) : Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Production	Season average price per ton ¹	Farm value
	1,000 acres	Tons	1,000 tons	Dollars	1,000 dollars
Average					
1909-13	267.4	15.76	4,307.8	3.734	16,266.0
1914-18	218.4	15.62	3,454.4	5.598	20,029.8
1919-23	209.0	13.86	2,944.4	7.262	18,969.8
1924-28	136.8	11.14	1,511.6	4.604	6,685.2
1929-33	186.8	14.14	2,639.0	3.358	8,875.6
1934-38	242.4	18.90	4,615.4	2.956	13,774.8
1939-43	239.8	18.22	4,402.0	3.698	16,671.2
Annual					
1944	246	20.0	4,929	4.98	24,546
1945	234	22.3	5,209	5.58	29,066
1946	255	17.6	4,484	6.55	29,370
1947	259	15.1	3,917	7.24	28,359
1948	274	19.2	5,257	5.88	30,911
1949	279	17.9	4,984	6.20	30,901
1950	273	19.5	5,312	7.88	41,859
1951	258	17.3	4,463	5.87	26,198
1952	275	20.6	5,667	6.64	37,629
1953	280	21.5	6,020	6.95	41,839

¹Does not include benefit payments.

Table 36—Sugar cane (for sirup): Acreage, yield, production, price, and value of sirup, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per gallon	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Gallons	1,000 gallons	1,000 gallons	Cents	1,000 dollars	1,000 dollars
Average							
1909-13	30.44	230.8	6,948.0	4,185.2	42.4	2,957.2	2,322.2
1914-18	41.72	230.2	9,528.8	6,777.6	54.6	5,441.8	4,641.8
1919-23	22.40	255.2	5,643.2	3,701.2	73.0	3,865.2	3,163.6
1924-28	29.80	239.6	6,518.2	5,909.4	40.0	2,609.4	2,472.6
1929-33	22.00	232.6	5,126.6	3,913.0	36.6	1,883.4	1,646.0
1934-38	25.60	262.4	6,703.8	4,746.2	38.4	2,577.2	2,289.8
1939-43	26.40	257.2	6,826.8	5,558.0	53.4	3,641.8	2,974.6
Annual							
1944	29.0	230	6,670	5,536	66	4,402	3,654
1945	335	335	15,075	13,275	74	11,156	9,824
1946	43.0	275	11,825	10,643	120	14,190	12,772
1947	36.0	235	8,460	7,614	80	6,768	6,091
1948	11.0	200	2,200	1,532	80	1,760	1,226
1949	11.0	250	2,750	2,199	70	1,925	1,539
1950	12.0	330	3,960	3,672	80	3,168	2,938
1951	9.0	320	2,880	2,627	85	2,448	2,233
1952	8.0	410	3,280	3,060	94	3,083	2,876
1953	5.0	460	2,300	2,052	93	2,139	1,908

Table 37—Corn: Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per bushel	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average							
1909-13	1,630.4	16.48	26,873.8	2,223.2	.734	19,639.6	1,592.4
1914-18	1,608.0	15.40	24,770.0	1,768.0	1.212	29,098.6	1,962.4
1919-23	1,443.6	16.00	23,188.4	904.4	1.094	24,869.6	952.8
1924-28	1,201.0	14.70	17,604.8	860.6	1.020	17,787.8	869.0
1929-33	1,336.4	14.00	18,745.6	961.6	.670	12,050.0	608.4
1934-38	1,589.8	14.62	23,235.2	1,638.0	.752	16,832.8	1,129.0
1939-43	1,440.2	15.20	17,694.0	1,298.8	.892	19,165.4	1,143.8
Annual							
1944	1,168	14.0	16,352	877	1.39	22,729	1,219
1945	1,075	18.5	19,888	1,273	1.39	27,644	1,769
1946	1,000	14.0	14,000	887	1.79	25,060	1,388
1947	960	13.5	12,960	762	2.20	28,512	1,676
1948	902	17.5	15,785	990	1.58	24,940	1,564
1949	758	21.0	15,918	992	1.30	20,693	1,290
1950	834	21.0	17,514	1,076	1.46	25,570	1,571
1951	709	23.0	16,307	1,012	1.65	26,907	1,670
1952	666	19.0	12,654	788	1.79	22,651	1,411
1953	546	20.0	10,920	611	1.60	17,472	978

Table 38.—Corn: Acreage planted with hybrid seed, 1938-53

Year	All corn (planted acreage)	Percentage planted with hybrid seed	Indicated hybrid corn acreage
	1,000 acres		1,000 acres
Average 1938-42	1,575.2	0.64	9.8
Annual			
1943	1,307	2.1	27
1944	1,229	3.7	45
1945	1,106	4.8	53
1945	1,040	8.0	83
1947	990	15.0	148
1948	955	17.5	167
1949	834	23.5	196
1950	834	21.0	270
1951	725	35.0	254
1952	703	39.5	278
1953	598	43.5	260

Table 39—Oats: Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per bushel	Farm value	Income from sales
			Production	Sold			
	1,000 bushels	Bushels	1,000 bushels	1,000 bushels	Cents	1,000 dollars	1,000 dollars
Average							
1909-13	33.4	18.6	622.2	31.00	59.6	368.0	18.4
1914-18	51.8	20.6	1,060.0	106.40	76.4	809.6	76.6
1919-23	32.2	21.7	693.0	35.00	80.6	594.0	29.2
1924-28	13.8	22.2	306.4	15.00	67.2	207.2	10.0
1929-33	21.4	22.2	476.0	21.00	47.4	213.6	9.2
1934-38	45.8	26.9	1,318.6	134.40	50.6	648.8	64.0
1939-43	91.2	30.2	2,717.6	458.40	55.0	1,591.8	273.8
Annual							
1944	152	29.0	4,408	793	98	4,320	777
1945	131	28.0	3,668	880	85	3,118	748
1946	100	22.0	2,200	374	116	2,552	434
1947	100	26.0	2,600	520	114	2,964	593
1948	80	30.0	2,400	504	106	2,544	334
1949	70	25.0	1,750	315	90	1,575	284
1950	48	21.5	1,032	155	99	1,022	153
1951	43	28.0	1,204	169	108	1,300	183
1952	48	35.0	1,680	286	105	1,764	300
1953	75	32.0	2,400	720	89	2,136	641

Table 40.—Soybeans (for beans): Acreage, yield, production, price, and value, 1924-53

Year	Acreage harvested	Yield per acre	Volume		Season average price	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average							
1924-28	15.2	8.6	130.8	96.2	3.106	397.4	291.6
1929-33	13.2	11.0	142.8	78.6	2.204	341.0	195.8
1934-38	12.6	12.1	154.4	66.0	1.890	287.4	127.6
1939-43	30.4	12.5	376.4	216.8	1.860	735.4	427.6
Annual							
1944	23	12.0	276	227	2.83	781	642
1945	23	14.0	322	244	2.65	853	647
1946	26	13.0	338	249	3.01	1,017	749
1947	23	12.5	288	224	3.33	959	746
1948	33	14.0	462	384	2.64	1,220	1,014
1949	23	15.0	345	308	2.31	866	711
1950	37	18.0	666	616	2.35	1,565	1,448
1951	38	17.5	665	617	2.65	1,762	1,635
1952	41	14.5	594	551	2.75	1,634	1,515
1953	40	16.0	640	595	2.50	1,600	1,488

Table 41.—Soybeans (for beans): Production, disposition, price, and value, 1924-53

Year	Production	Farm disposition				Season average price per bushel	Value of production	Value of sales
		Used for seed		Fed to live- stock	Sold			
		Total	On-farms where grown					
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average								
1924-28	130.8	58.4	11.6	23.0	96.2	3.106	397.4	291.6
1929-33	142.8	59.2	23.0	41.2	78.6	2.204	341.0	195.8
1934-38	154.4	148.4	51.2	37.2	66.0	1.890	287.4	127.6
1939-43	376.4	273.0	109.4	50.2	216.8	1.860	735.4	427.6
Annual								
1944	276	233	35	14	237	2.83	781	642
1945	322	237	39	39	244	2.65	853	647
1946	338	235	38	51	249	3.01	1,017	749
1947	288	199	24	40	224	3.33	957	746
1948	462	153	23	55	384	2.64	1,220	1,014
1949	345	167	20	17	308	2.31	797	711
1950	666	202	30	20	616	2.35	1,565	1,448
1951	665	206	31	17	617	2.65	1,762	1,635
1952	594	199	28	15	551	2.75	1,634	1,515
1953	640	252	35	10	595	2.50	1,600	1,488

Table 42.—Cowpeas (for peas): Acreage, yield, production, price, and value, 1924-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per bushel	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average							
1924-28	28.0	8.80	247.2	67.4	3.020	753.6	233.4
1929-33	42.2	4.56	184.2	24.4	1.868	318.6	40.8
1934-38	65.4	3.48	227.4	35.2	1.760	402.8	62.6
1939-43	56.8	4.52	253.4	52.8	2.118	531.6	111.6
Annual							
1944	23	8.0	184	71	3.34	615	237
1945	18	8.0	144	37	3.45	497	128
1946	15	7.0	105	23	4.30	452	99
1947	19	8.0	152	48	4.77	725	229
1948	20	6.0	120	29	4.31	587	125
1949	17	7.5	128	43	3.54	453	152
1950	13	7.5	98	31	4.33	424	134
1951	9	8.5	76	18	4.67	355	84
1952	12	7.0	84	22	4.50	378	99
1953	13	8.5	110	35	4.45	490	146

Table 43—Cowpeas (for peas): production, disposition, price, and value, 1924-53

Year	Farm disposition							Season average price per bushel	Value of pro- duction dollars	Value of home con- sumption dollars	Value of sales dollars
	Pro- duc- tion	Used for seed		Fed to live- stock	For farm hold- use	Sold	1,000 bushels				
		Total	On farms where grown								
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	
Average											
1924-28	247.2	81.0	41.8	100.8	31.2	73.4	3.020	753.6	93.6	233.4	
1929-33	184.2	115.2	81.0	53.4	25.4	24.4	1.868	318.6	46.2	40.8	
1934-38	227.4	207.2	98.2	65.0	29.0	35.2	1.760	402.8	50.8	62.6	
1939-43	253.4	165.8	93.0	75.6	32.0	52.8	2.118	531.6	69.0	111.6	
Annual											
1944	184	65	39	50	24	71	3.34	615	80	237	
1945	144	54	35	50	22	37	3.45	497	76	128	
1946	105	44	33	34	15	23	4.30	432	64	99	
1947	152	45	35	46	23	48	4.77	725	110	229	
1948	120	46	35	38	18	29	4.31	517	78	125	
1949	128	38	28	38	19	43	3.54	453	67	152	
1950	98	29	20	30	17	31	4.33	424	74	134	
1951	76	30	22	23	13	18	4.67	355	61	84	
1952	84	31	23	25	14	22	4.50	378	63	99	
1953	110	31	23	33	19	35	4.45	490	85	156	

Table 44—Velvet beans: Acreage, yield, production, price, and value, 1924-52

Year	Acreage harvested	Yield per acre	Production	Season average price per ton	Farm value
	1,000 acres	Pounds	1,000 tons	Dollars	1,000 dollars
Average					
1924-28	37.8	1,000	18.6	17.16	318.8
1929-33	42.0	840	17.6	13.04	229.2
1934-38	62.6	764	23.8	17.60	418.8
1939-43	88.6	718	31.8	20.08	635.4
Annual					
1944	41	700	14	28.00	392
1945	25	760	10	29.00	290
1946	22	600	7	35.00	245
1947	18	575	5	35.00	175
1948	8	650	3	35.00	105
1949	4	725	1	35.00	35
1950	5	850	2	35.00	60
1951	3	650	1	35.00	35
1952 ¹	2	600	1	35.00	35

¹This series discontinued in 1953.

Table 45—All hay: Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price ¹		Farm value ¹		Income from sales ¹	
			Production	Sold	Loose	Baled	Loose	Baled	Loose	Baled
	1,000 acres	Tons	1,000 tons	1,000 tons	Dollars per ton	Dollars per ton	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Average										
1909-13	178.8	1,298	232.0	37.8	11.98		2,770.0		450.8	
1914-18	195.2	1,244	241.8	25.0	14.78		3,543.2		448.8	
1919-23	214.0	1,246	267.0	29.2	16.48		4,386.8		469.8	
1924-28	200.4	1,096	218.8	24.8	15.62		3,337.8		371.8	
1929-33	241.2	1,202	289.6	27.6	9.68		2,711.6		260.2	
1934-38	300.4	1,116	335.0	29.4	9.70		3,232.2		285.4	
1939-43	331.2	1,228	328.6	39.6		13.74		5,515.6		550.2
Annual										
1944	331	1.19	395	43		21.70		8,572		933
1945	326	1.25	406	47		21.40		8,688		1,006
1946	319	1.26	403	50		23.40		9,430		1,170
1947	300	1.18	354	39		24.90		8,815		971
1949	294	1.12	329	33		26.40		8,686		871
1949	295	1.28	379	40		22.50		8,528		900
1950	289	1.36	394	47		24.40		9,614		1,147
1951	298	1.15	344	34		28.50		9,804		969
1952	343	1.18	404	44		29.80		12,039		1,311
1953	321	1.26	406	45		25.50		10,353		1,148

¹Prices for hay 'loose' from 1909 through 1939, for hay 'baled' following 1939.

Table 46.—Annual legume hay: Acreage, yield, and production, 1919-52

Year	Acreage harvested				Yield per acre	Production 1,000 tons
	Soybeans	Cowpeas	Peanuts	Total		
	1,000 acres	1,000 acres	1,000 acres	1,000 acres	Tons	
Average				98.2	1.130	110.2
1919-23	---	---	---	108.8	1.078	118.0
1924-28	42.4	58.0	8.4	136.4	1.096	148.8
1929-33	67.8	53.0	15.6	158.8	.976	154.8
1934-38	64.0	78.6	16.2	135.0	1.058	143.4
1939-43	77.8	35.6	21.6			
Annual						
1944	34	18	8	60	1.20	72
1945	29	12	6	54	1.30	70
1946	47	12	5	64	1.20	77
1947	38	12	6	56	1.14	64
1948	39	13	5	57	1.05	60
1949	35	13	4	52	1.12	58
1950	12	7	4	23	1.09	25
1951	12	4	4	20	.95	19
1952 ¹	17	5	3	25	.96	24

¹This series discontinued in 1953.

Table 47—Alfalfa hay: Acreage, yield, and production, 1919-53

Year	Acreage harvested	Yield per acre	Production
	1,000 acres	Tons	1,000 tons
Average			
1919-23	13.0	2.436	31.6
1924-28	9.8	2.042	19.8
1929-33	15.2	2.200	33.8
1934-38	21.0	2.060	43.6
1939-43	27.4	2.156	59.2
Annual			
1944	22	1.75	38
1945	20	2.20	44
1946	19	1.80	34
1947	16	2.00	32
1948	19	2.10	40
1949	22	1.90	42
1950	20	1.90	38
1951	19	1.80	34
1952	22	1.90	42
1953	22	2.00	44

Table 48.—Lespedeza hay: Acreage, yield, and production, 1924-53

Year	Acreage harvested	Yield per acre	Production
	1,000 acres	Tons	1,000 tons
Average			
1924-28	29.8	1.01	28.8
1929-33	27.0	1.11	30.0
1934-38	40.8	1.17	48.0
1939-43	75.8	1.25	94.0
Annual			
1944	117	1.15	135
1945	116	1.20	139
1946	109	1.40	153
1947	104	1.10	114
1948	102	1.00	104
1949	91	1.21	146
1950	89	1.45	129
1951	98	1.00	98
1952	108	1.10	119
1953	81	1.10	89

Table 49.—Miscellaneous hay: Acreage, yield, and production, 1929-53

Year	Acreage harvested	Yield per acre	Production
	1,000 acres	Tons	1,000 tons
Average			
1929-33	62.6	1.218	77.0
1934-38	75.2	1.136	84.6
1939-43	77.6	1.192	92.6
Annual			
1944	109	1.20	131
1945	120	1.20	144
1946	117	1.10	129
1947	123	1.15	141
1948	116	1.10	128
1949	122	1.20	157
1950	131	1.30	170
1951	134	1.20	161
1952	154	1.15	177
1953	177	1.25	221

Table 50.—Lespedeza seed: Acreage, yield, production, price, and value, 1924-51

Year	Acreage harvested	Yield per acre	Volume		Season average price per cwt.	Farm value	Income from sales
			Production	Sold			
	Acres	Pounds	1,000 pounds	1,000 pounds	Dollars	1,000 dollars	1,000 dollars
Average							
1924-28	9,680	125.0	1,196.4		14.34	178.2	
1929-33	4,140	104.0	426.0		10.64	45.6	
1934-38	3,100	103.0	324.2		9.24	31.0	
1939-43	7,900	122.0	754.0	504.2	16.04	120.2	79.0
Annual							
1944	12,000	145	1,400	1,106	22.60	316	250
1945	10,000	145	1,500	1,125	21.20	318	238
1946	8,000	140	1,500	1,005	26.50	398	266
1947	3,000	120	500	385	30.00	150	116
1948	3,500	130	660	462	30.20	199	140
1949	2,500	120	450	279	25.70	115	71
1950	1,300	130	300	195	32.50	98	63
1951 ¹	1,800	94	170	105	31.80	54	34

¹Series discontinued in 1952.

Table 51—White clover seed: Acreage, yield, production, price, and value, 1930-53

Year	Acreage harvested	Yield per acre	Production	Season average price per cwt.	Farm value
	Acres	Pounds ¹	1,000 pounds ¹	Dollars ¹	1,000 dollars ¹
Average					
1930	—	—	900	23.00	207
1931-35	—	—	690	15.17	105
1936-40	7,920	41.0	326	25.70	80
1941-45	10,620	43.4	490	55.03	257
Annual					
1944	11,800	40	470	59.00	277
1945	8,600	35	410	68.00	279
1946	8,000	40	400	74.00	296
1947	12,000	60	580	43.50	252
1948	11,000	65	600	47.50	285
1949	7,000	60	270	76.00	205
1950	5,100	45	230	80.00	184
1951	17,500	80	1,400	60.00	840
1952	22,000	55	1,210	55.50	672
1953	6,600	30	198	49.00	97

¹ Clean seed basis.

Table 52.—Peanuts (picked and threshed): Acreage, yield, production, price, and value, 1909-52

Year	Acreage harvested	Yield per acre	Volume		Season average price per pound	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Pounds	1,000 pounds	1,000 pounds	Cents	1,000 dollars	1,000 dollars
Average							
1909-13	4.4	690	3,025	627.2	3.74	113.8	23.6
1914-18	7.2	665	3,025	1,819.6	5.42	257.4	101.0
1919-23	7.4	555	4,070	1,735.6	7.24	292.0	122.6
1924-28	6.6	481	2,196	1,005.4	6.76	219.8	70.8
1929-33	10.4	513	5,294	1,214.2	5.10	258.4	62.8
1934-38	11.2	394	4,408	376.4	4.96	218.0	18.8
1939-43	14.8	340	5,017	2,156.4	5.68	289.6	129.6
Annual							
1944	5	275	1,375	191	8.4	116	16
1945	5	385	1,925	826	9.0	173	74
1946	4	280	1,120	108	10.8	121	12
1947	4	300	1,200	238	12.9	155	31
1948	3	335	1,005	279	14.0	141	39
1949	3	360	1,080	396	13.4	145	53
1950	3	340	1,020	439	15.0	153	66
1951	3	325	975	456	14.6	142	67
1952 ¹	2	350	700	236	15.9	111	38

¹Series discontinued in 1953.

Table 53—Irish potatoes (all): Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per bushel	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average							
1909-13	21.6	59.6	1,282.0	972.6	.946	1,204.4	914.2
1914-18	23.8	65.4	1,598.0	1,246.0	1.354	2,147.6	1,668.6
1919-23	22.4	58.6	1,316.6	964.2	1.686	2,188.8	1,604.6
1924-28	32.0	59.0	1,884.8	1,259.6	1.456	2,712.0	1,801.0
1929-33	37.8	59.2	2,271.2	1,466.4	.954	1,979.2	1,282.6
1934-38	41.4	63.8	2,637.4	1,898.6	.742	1,959.6	1,424.0
1939-43	44.4	59.2	2,639.4	2,033.6	.970	2,694.4	2,126.4
Annual							
1944	59.0	57	3,363	2,624	1.22	4,103	3,201
1945	38.0	62	2,356	1,838	1.93	4,945	3,547
1946	33.0	58	1,914	1,604	1.37	3,124	2,197
1947	24.0	54	1,296	1,119	1.60	2,629	1,790
1948	17.0	60	1,020	918	1.91	2,705	1,753
1949	14.0	60	840	756	1.91	2,366	1,444
1950	14.0	63	882	436	1.57	1,385	685
1951	12.0	62	744	384	1.67	1,242	641
1952	10.6	72	763	430	2.70	2,060	1,161
1953	11.6	86	998	674	1.10	1,098	741

Table 54.—Sweet potatoes: Acreage, yield, production, price, and value, 1909-53

Year	Acreage harvested	Yield per acre	Volume		Season average price per bushel	Farm value	Income from sales
			Production	Sold			
	1,000 acres	Bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
Average							
1909-13	57.0	78.4	4,470.0	1,458.4	.708	3,166.4	1,033.6
1914-18	62.0	76.8	4,758.0	1,667.4	.914	4,313.6	1,520.4
1919-23	66.2	83.0	5,504.0	2,166.2	1.150	6,287.0	2,447.4
1924-28	64.2	70.4	4,635.6	1,965.6	1.278	5,533.8	2,387.8
1929-33	83.8	69.6	5,797.8	2,417.2	.796	4,310.6	1,895.8
1934-38	111.4	71.6	7,962.8	3,433.0	.704	5,572.6	2,400.4
1939-43	80.6	77.8	7,539.6	3,774.6	.984	7,944.6	4,058.4
Annual							
1944	100	98	9,800	6,135	1.45	14,210	8,896
1945	116	105	12,180	8,008	1.46	17,783	11,692
1946	125	90	11,250	7,240	1.57	17,662	11,367
1947	94	85	7,990	4,974	1.52	12,145	7,560
1948	86	95	8,170	5,158	1.60	13,022	8,253
1949	92	95	8,740	5,438	1.69	14,771	9,190
1950	107	102	10,914	6,847	.98	10,696	6,710
1951	73	100	7,300	5,290	2.85	20,805	15,076
1952	88	90	7,920	6,141	2.79	22,097	17,133
1953	96	91	8,736	6,642	1.87	16,336	12,421

Table 55.—Strawberries¹: Acreage, yield, production, and value, 1918-53

Year	Acreage	Yield	Production	Season average	Total value
		per acre		price per 24-pint crate	
	Acres	24-pint crates	1,000 crates	Dollars	1,000 dollars
Average					
1918-22	7,022	152.0	1,071.2	2.950	3,050.2
1923-27	15,778	94.4	1,474.4	3.040	4,529.8
1928-32	22,540	124.4	2,779.2	2.210	5,981.0
1933-37	17,880	135.6	2,390.8	1.529	3,623.2
1938-42	21,780	116.0	2,519.6 ²	1.731	4,223.4
Annual					
1943	13,900	90	1,252	3.655	4,573
1944	9,500	110	1,044	5.000	5,218
1945	10,500	140	1,470	5.075	7,462
1946	15,400	140	2,156	5.220	11,257
1947	17,800	100	1,780	4.510	8,030
1948	14,400	120	1,728	5.170	8,930
1949	13,400	90	1,206	5.305	6,399
1950	13,300	100	1,330	4.795	6,380
1951	13,400	90	1,205 ³	4.375	4,574
1952	5,800	130	754	5.435	4,098
1953	9,000	160	1,440	4.965	7,150

¹Includes strawberries for processing.

²Includes some quantities not marketed and excluded in computing value; 198,000 crates in 1938; 306,000 crates in 1941.

³Includes 160,000 crates not marketed and excluded in computing value in 1951.

Table 56.—Peaches: Production, price, and value, 1909-53

Year	Volume		Season average price	Farm value	Income from sales
	Production	Sold			
	1,000 bushels	1,000 bushels	Dollars per bushel	1,000 dollars	1,000 dollars
Average					
1909-13	417.2	243.6	1.016	421.0	243.8
1914-18	385.0	206.8	1.090	419.4	225.0
1919-23	232.4	96.2	1.860	441.0	185.2
1924-28	192.8	66.4	1.700	324.8	111.6
1929-33	221.6	88.2	1.330	283.0	108.4
1934-38	289.6	154.0	1.030	295.0	155.8
1939-43	302.8	155.8	1.500	402.6	204.0
Annual					
1944	296	135	3.00	888	405
1945	265	185	2.95	782	546
1946	201	133	3.05	613	406
1947	148	96	2.85	422	274
1948	139	99	2.90	403	287
1949	76	48	2.80	213	134
1950	54	26	3.40	184	88
1951	63	35	3.40	214	119
1952	66	38	3.30	218	125
1953	179	119	3.10	555	369

Table 57.—Pears: Production, price, and value, 1909-53

Year	Volume		Season average price	Farm value	Income from sales
	Production	Sold			
	1,000 bushels	1,000 bushels	Dollars per bushel	1,000 dollars	1,000 dollars
Average					
1909-13	38.0	17.0	----	----	----
1914-18	53.2	30.6	----	----	----
1919-23	51.4	27.6	1.74	73.2	47.0
1924-28	64.4	39.2	1.48	94.8	57.6
1929-33	87.8	57.8	1.05	89.2	58.6
1934-38	149.6	108.4	.63	91.0	65.6
1939-43	176.0	125.4	.83	123.2	86.4
Annual					
1944	245	183	1.25	306	229
1945	228	143	1.30	226	186
1946	235	130	1.50	288	195
1947	207	101	1.45	233	146
1948	240	95	1.25	200	119
1949	198	60	1.30	156	78
1950	105	45	1.30	136	58
1951	70	22	1.55	108	34
1952	110	54	1.50	165	81
1953	110	54	1.45	160	78

Table 58.—Oranges: Production, disposition, price, and value, 1919-53

Year	Production	Farm disposition		Season average price per box	Value of	
		Home consumption	Sold		Production	Sales
	1,000 boxes	1,000 boxes	1,000 boxes	Dollars	1,000 dollars	1,000 dollars
Average						
1919-23	52.8	13.2	39.6	2.010	99.2	72.8
1924-28	149.0	17.4	131.6	2.414	384.0	341.2
1929-33	248.4	21.6	226.8	1.688	401.8	366.2
1934-38	293.8	25.8	268.0	1.334	383.6	349.4
1939-43	250.6	17.0	233.6	1.790	463.0	434.4
Annual						
1944	360	14	346	2.60	936	900
1945	330	14	316	2.55	842	806
1946	410	16	394	1.90	779	749
1947	300	16	284	1.75	525	497
1948	300	16	284	1.85	555	525
1949	370	16	354	2.20	814	779
1950	300	15	285	2.15	645	613
1951	50	5	45	3.80	190	171
1952	50	5	45	3.50	175	158
1953	100	10	90	3.00	300	270

Table 59.—Watermelons (market) : Acreage, yield, production, price, and value, 1934-53

Year	Acreage harvested	Yield per acre	Production	Season average price per thousand	Total value
	Acres	Melons	1,000 melons	Dollars	1,000 dollars
Average					
1934-38	4,060	286	1,176.6	96.8	115.8
1939-43	6,440	294	1,870.8	225.6	398.4
1944-48	6,380	254	1,622.0	449.2	728.2
Annual					
1949	4,700	260	1,222	407	497
1950	4,500	250	1,125	475	534
1951	3,900	260	1,014	470	477
1952	3,500	250	875	425	372
1953	2,800	250	700	486	340

Table 60.—Tomatoes (market) : Acreage, yield, production, price, and value, 1925-53

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bu hels	1,000 bushels	Dollars	1,000 dollars
Average					
1925-29	1,338	90.6	119.4	1.66	191.4
1930-34	1,680	96.2	161.2	1.08	165.6
1935-39	2,800	73.6	206.4	.95	193.2
1940-44	2,820	63.0	178.8	2.10	331.6
Annual					
1945	2,200	80	176	3.35	590
1946	1,800	60	108	3.50	378
1947	1,500	60	90	2.55	230
1948	1,300	80	104	3.50	364
1949	1,400	70	98	2.55	250
1950	1,200	70	84	5.70	479
1951	1,100	75	82	3.70	303
1952	1,100	70	77	5.50	424
1953	600	60	36	8.00	288

Table 61.—Cabbage (market): Acreage, yield, production, price, and value, 1918-53

Year	Acreage harvested	Yield per acre	Production	Season average price per ton	Total value
	Acres	Tons	Tons	Dollars	1,000 dollars
Average					
1918-22	1,226.0	5.5	8,460.0	38.04	295.8
1923-27	2,500.0	4.9	12,240.0	34.20	385.2
1928-32	1,460.0	3.9	13,580.0	24.82	313.8
1933-37	4,220.1	3.3	14,280.0	19.34	249.8
1938-42	4,658.0	4.0	18,600.0	19.50	337.4
1943-47	7,260.0	4.2	30,820.0	37.58	1,049.4
Annual					
1948	5,000	4.0	20,000	45.20	904
1949	5,300	4.2	22,300	29.00	647
1950	5,600	5.2	29,100	15.40	448
1951	1,800	3.5	6,300	61.60	388
1952	3,000	5.0	15,000	58.00	870
1953	5,200	5.5	28,600	16.90	483

Table 62.—Snap beans (mid-spring market): Acreage, yield, production, price, and value, 1918-53

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1918-22	1,532	80.6	123.8	2.240	282.2
1923-27	4,288	68.6	281.8	1.840	481.0
1928-32	7,880	68.4	540.6 ¹	1.062	562.4
1933-37	7,860	64.4	503.8 ¹	.920	451.0
1938-42	8,280	61.0	501.8 ¹	1.080	503.8
Annual					
1943	8,000	50	400	2.30	920
1944	6,000	75	450	2.25	1,012
1945	6,000	90	540	2.50	1,350
1946	7,200	60	432	2.10	907
1947	5,400	50	270	2.30	621
1948	4,500	70	315	2.75	866
1949	3,700	75	278	2.75	764
1950	4,400	80	352	2.45	862
1951	4,200	75	315	2.50	788
1952	4,000	70	280	2.70	756
1953	3,800	75	285	2.50	712

¹Includes some quantities not marketed and excluded in computing value: 52,000 bushels in 1932; 98,000 bushels in 1934; 102,000 bushels in 1940.

Table 63.—Snap beans (early fall market); Acreage, yield, production, price, and value, 1922-53

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1922-26	1,680.0	67.8	102.8	1.79	182.0
1927-31	3,400.0	61.8	209.6	1.18	252.4
1932-36	4,600.0	50.4	228.0	.796	188.6
1937-41	3,900.0	62.0	246.0	1.08	238.6
1942-46	2,520.0	75.0	192.8	2.38	468.8
Annual					
1947	2,400	50	120	2.40	288
1948	2,000	80	160	2.30	368
1949	2,000	75	150	1.50	225
1950	2,200	85	187	2.20	411
1951	1,800	75	135	2.95	398
1952	1,700	60	102	3.20	326
1953	1,500	70	105	1.95	205

Table 64.—Onions (market): Acreage, yield, production, price, and value, 1918-52

Year	Acreage harvested	Yield per acre	Production, 50-lb. sacks	Season average price per 50-lb. sack	Total value
	Acres	50-lb. sacks	1,000	Dollars	1,000 dollars
Average					
1918-22	1,144	202.8	232.0	1.754	386.0
1923-27	2,168	114.0	251.6	1.286	309.8
1928-32	1,612	98.0	171.2	.982	167.0
1933-37	1,220	90.4	112.0	.748	80.8
1938-42	1,493	99.0	148.8	.934	132.6
Annual					
1943	1,550	90	140	1.65	231
1944	1,800	90	162	2.60	421
1945	2,000	120	240	2.10	504
1946	2,000	105	210	2.20	462
1947	1,100	80	88	1.70	150
1948	450	95	43	2.60	112
1949	500	100	50	2.00	100
1950	450	95	43	1.50	64
1951	400	90	36	2.15	77
1952 ¹	350	90	32	3.35	107

¹Series discontinued in 1953.

Table 65.—Shallots (market): Acreage, yield, production, price, and value, 1937-53

Year	Acreage harvested	Yield per acre	Production	Season average price	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Spring (market)					
Average 1937-41	2,360	216.2	293.4 ¹	.732	205.4
Annual					
1942	2,400	140	336	.78	260
1943	2,300	84	192	1.78	341
1944	2,100	80	168	2.50	420
1945	2,200	104	228	1.34	305
1946	2,200	100	220	1.90	418
1947	2,000	100	200	1.80	360
1948	1,900	100	192	1.55	298
1949	1,600	60	96	2.08	199
1950	1,900	112	212	1.61	334
1951	2,000	107	214	1.80	390
1952	2,500	132	328	1.25	410
1953	1,700	132	224	1.92	431
1954	2,000	120	240		
Winter (market)					
Average 1937-41	2,820	102.2	289.6	.812	226.2
Annual					
1942	2,800	124	348	.85	296
1943	2,700	108	292	1.25	365
1944	1,900	100	192	2.25	432
1945	2,700	140	376	1.88	705
1946	3,200	140	448	1.90	851
1947	2,700	88	236	2.18	513
1948	2,900	112	324	1.69	547
1949	2,900	100	288	1.64	472
1950	2,600	96	248	2.40	595
1951	3,000	80	240	2.80	677
1952	3,500	132	464	1.70	789
1953	3,500	116	408	2.75	1,122
1954	2,500	112	260		

¹Includes 48,000 bushels not marketed and excluded in computing value in 1939.

Table 66.—Garlic (market) : Acreage, yield, production, price, and value, 1932-52

Year	Acreage harvested	Yield per acre	Production, 100-lb. sacks	Season average price per 100-lb. sack	Total value
	Acres	100-lb. sacks	1,000	Dollars	1,000 dollars
Average					
1932-36	540	13.42	7.2	3.70	25.8
1937-41	680	13.86	9.6	4.55	43.6
Annual					
1942	700	14.0	10	4.00	40
1943	480	13.6	7	5.00	35
1944	380	13.0	5	8.00	40
1945	310	13.0	4	15.50	62
1946	250	12.5	3	20.00	60
1947	180	13.5	2	13.50	27
1948	130	12.5	2	10.50	21
1949	100	12.5	1	9.80	10
1950	90	13.0	1	9.20	9
1951	60	13.0	1	10.60	11
1952 ¹	50	13.0	1	10.00	10

¹Series discontinued in 1953.

Table 67.—Green peppers (market) : Acreage, yield, production, price, and value, 1924-53

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1924-28	1,650	161.0	260.6	1.200	310.2
1929-33	1,100	182.0	202.2	.746	150.0
1934-38	1,280	187.6	243.6	.510	124.8
1939-43	1,340	152.0	204.0	1.100	225.8
Annual					
1944	1,800	165	297	1.90	564
1945	2,000	170	340	2.20	748
1946	2,500	100	250	2.20	550
1947	2,500	135	338	2.75	930
1948	2,700	160	432	2.00	864
1949	3,000	135	405	2.60	1,053
1950	2,700	115	310	1.50	465
1951	2,900	140	406	.95	386
1952	2,800	130	364	4.45	1,620
1953	2,400	110	264	4.35	1,148

Table 68.—Carrots (market): Acreage, yield, production, price, and value, 1923-52

Year	Acreage harvested	Yield per acre	Production	Season average price	Total value
	Acres	Bushels	1,000 bushels	Dollars per bushel	1,000 dollars
Average					
1923-27	2,670	226.2	569.4	.744	385.6
1928-32	2,300	134.0	311.2	.468	152.6
1933-37	1,980	118.2	233.0	.458	107.8
1938-42	2,040	91.0	187.6	.840	143.8
Annual					
1943	1,700	70	119	1.70	202
1944	1,500	65	98	1.85	181
1945	1,500	70	105	2.10	220
1946	900	70	63	2.40	151
1947	800	65	52	2.30	120
1948	750	65	49	2.70	132
1949	700	65	46	2.25	104
1950	650	65	42	2.25	94
1951	550	55	30	2.90	87
1952 ¹	550	60	33	3.10	102

¹Series discontinued in 1953.

Table 69.—Cucumbers: Acreage, yield, production, price, and value, 1923-53

	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Early fall (market)					
Average					
1928-32	836.0	81.8	68.4	1.088	74.2
1933-37	790.0	77.8	41.6	.960	57.8
1938-42	930.0	88.0	83.6	1.326	99.4
1943-47	1,200.0	91.0	111.6	2.680	277.6
Annual					
1948	900	65	58	2.30	133
1949	1,100	80	88 ¹	1.80	126
1950	1,200	125	150	2.00	300
1951	900	55	50	2.65	132
1952	900	105	94	1.90	179
1953	1,000	100	100	2.20	220
Late spring (market)					
Average					
1923-27	510.0	84.0	42.4	1.660	68.2
1928-32	642.0	98.6	61.2	1.032	65.4
1933-37	516.0	81.0	42.0	.726	31.0
1938-42	550.0	88.0	48.6	.850	41.8
1943-47	826.0	89.0	74.4	2.000	147.8
Annual					
1948	750	100	75	2.50	188
1949	650	80	52	1.95	101
1950	600	100	60	1.80	108
1951	600	95	57	1.50	86
1952	600	100	60	2.55	153
1953	450	80	36	2.90	104

¹Includes 18,000 bushels not marketed and excluded in computing value.

Table 70.—Spinach (market): Acreage, yield, production, price, and value, 1925-52

Year	Acreage harvested	Yield	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1925-29	1,870	104.4	195.4	.462	90.2
1930-34	1,478	81.0	115.0	.378	42.4
1935-39	1,200	102.4	123.2	.476	58.8
1940-44	1,160	82.0	96.0	.820	73.8
Annual					
1945	900	75	68	1.15	78
1946	900	70	63	1.20	76
1947	800	65	52	1.35	70
1948	650	70	46	1.45	67
1949	600	70	42	1.50	63
1950	500	75	38	1.20	46
1951	400	45	18	1.90	34
1952 ¹	300	70	21	1.45	30

¹Series discontinued in 1953.

Table 71.—Eggplant (market): Acreage, yield, production, price, and value, 1925-52

Year	Acreage harvested	Yield	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1925-29	544	157.8	84.8	1.060	90.2
1930-34	530	149.0	78.8	.824	72.0
1935-39	630	133.8	85.0	.630	53.2
1940-44	520	150.0	77.6	1.160	89.6
Annual					
1945	400	150	60	1.95	117
1946	400	135	54	1.60	86
1947	350	145	51	1.45	74
1948	330	135	45	1.35	61
1949	300	140	42	1.60	67
1950	300	150	45	1.30	58
1951	300	150	45	1.30	58
1952 ¹	300	150	45	1.85	83

¹Series discontinued in 1953.

Table 72.—Beets (market): Acreage, yield, production, price, and value, 1927-52

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
Average					
1927-31	2,540	129.8	325.0	.508	167.6
1932-36	1,980	122.8	243.0	.402	97.2
1937-41	1,120	108.0	125.4	.650	75.2
1942-46	640	63.0	40.0	1.720	68.0
Annual					
1947	350	60	21	1.65	35
1948	250	55	14	2.10	29
1949	300	60	18	2.30	41
1950	200	80	16	1.85	30
1951	120	55	7	2.15	15
1952 ¹	100	65	6	2.10	13

¹Series discontinued in 1953.

Table 73.—Commercial vegetables for processing: Acreage, production, and value, 1928-53

Year	Acreage harvested	Production	Season average price	Total value
	Acres	Tons	Dollars per ton	1,000 dollars
Average				
1928-32	3,194	3,360	39.16	128.4
1933-37	2,276	2,868	19.96	57.8
1938-42	3,960	5,062	27.58	145.6
Annual				
1943	5,800	6,000	65.40	393
1944	4,300	4,600	59.50	276
1945	3,430	5,800	56.15	324
1946	3,620	4,000	70.35	282
1947	3,190	3,800	76.39	275
1948	1,830	1,900	68.30	127
1949	1,780	1,800	65.00	117
1950	2,000	3,800	40.26	153
1951	1,250	2,000	63.50	127
1952	1,152	1,600	68.13	109
1953	1,210	900	83.33	75

Table 74—Pecans (improved and seedling): Production, price, and value, 1919-53

Year	Production			Quantity Sold			Season Average Price ¹				Total Farm Value		Cash Receipts	
	Improved varieties	Wild or seedling varieties	Total	Improved varieties	Wild or seedling varieties	Total	Improved varieties	Wild or seedling varieties	Total	Cents per pound	All varieties	dollars	All varieties	dollars
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	Cents per pound	Cents per pound	Cents per pound	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Average														
1919-23	518.0	2,712.0	3,230.0			2,513.2	38.50 ²	16.50 ³	24.28	753.8	584.0			
1924-28	790.0	3,416.0	4,206.0			3,262.6	34.20	16.14	19.52	762.8	581.2			
1929-33	1,522.2	5,590.6	7,112.8			6,152.8	18.90	9.50	11.46	730.2	623.8			
1934-38	2,016.4	5,566.8	7,583.2	2,333.0 ²	5,555.0 ²	6,663.2	14.42	8.70	10.20	739.2	644.6			
1939-43	2,233.4	5,758.6	7,992.0	5,218.6	1,893.4	7,112.0	17.70	11.14	12.98	1,100.2	978.6			
Annual														
1944	3,744	10,656	14,400	3,314	9,936	13,250	25.7	16.2	18.6	2,688	2,462			
1945	1,900	7,700	9,600	1,480	7,100	8,580	26.2	20.0	21.1	2,038	1,808			
1946	2,300	7,150	9,450	1,880	6,550	8,430	35.1	29.4	30.7	2,909	2,586			
1947	1,500	4,000	5,500	1,150	3,500	4,650	35.5	21.0	24.6	1,372	1,143			
1948	4,700	14,300	19,000	4,350	13,650	18,000	18.0	10.5	12.3	2,348	2,216			
1949	3,950	13,050	17,000	3,600	12,400	16,000	21.0	16.0	17.1	2,918	2,740			
1950	1,900	7,200	9,100	1,600	6,600	8,200	32.0	25.0	26.4	2,408	2,162			
1951	3,450	12,250	15,700	3,100	11,600	14,700	24.0	18.0	19.3	3,033	2,832			
1952	3,200	10,300	13,500	2,900	9,700	12,600	25.0	18.5	20.0	2,706	2,519			
1953	4,600	17,000	21,600	4,200	16,300	20,500	21.0	15.0	16.2	3,516	3,327			

¹December 1 price prior to 1937.

²Two-year average, 1937-38.

³Two-year average, 1922-23.

Table 75—Tung nuts: Production, price, and value, 1939-53

Year	Production ¹	Season average price per ton	Farm value
	Tons	Dollars	1,000 Dollars
Average 1939-43	2,082	74.40	182
Annual			
1944	7,550	103.00	778
1945	10,750	101.00	1,086
1946	15,200	90.00	1,368
1947	15,500	64.00	992
1948	14,000	50.00	700
1949	25,200	64.00	1,613
1950	6,100	94.00	573
1951	2,900	97.00	281
1952	30,200	77.00	2,325
1953	25,000	65.00	1,625

¹Includes small quantities of tung nuts produced in Texas.

Table 76—Tobacco (perique): Acreage, yield, production, price, and value, 1919-53

Year	Acreage harvested	Yield per acre	Production	Season average price per pound	Farm value
	Acres	Pounds	1,000 pounds	Cents	1,000 dollars
Average					
1919-23	900	450	404.0	53.0	213.8
1924-28	400	415	168.6	49.0	89.4
1929-33	440	422	186.6	29.2	53.6
1934-38	260	450	125.0	24.6	35.4
1939-43	440	356	157.0	27.8	45.0
Annual					
1944	400	525	210	42.5	89
1945	300	640	192	65.0	125
1946	300	500	150	80.0	120
1947	600	415	249	60.0	149
1948	300	800	240	60.0	144
1949	300	667	200	60.0	120
1950	400	375	150	60.0	90
1951	400	660	264	60.0	158
1952	350	650	228	56.0	128
1953	250	670	168	61.0	102

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Economic Appraisal of
F. D. Hanson
**Farming Practices and
Rotation Programs**
on Louisiana Rice Farms

by Troy Mullins



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SUMMARY

Rapid change has characterized rice farming in Louisiana during recent years. The use of combines for harvesting has reduced the direct labor for this operation to less than 2 man-hours per acre. This is only one-eighth of all direct labor used in the production and harvesting of rice. About one-third of the total of 14 man-hours per acre is used in land preparation, seeding, and levee construction, and one-half is devoted to the yet unmechanized jobs of spreading water, attending levees, and miscellaneous work.

About half of the 1953 rice acreage in Louisiana was in long grain varieties compared to only 13 per cent during 1935-39. The use of fertilizer is a standard practice, with 150 pounds per acre of such analyses as 4-12-4 and 5-10-5 comprising the average application. Experimental results and the experiences of farmers indicate that application of as much as 60 pounds of nitrogen would be profitable under the cost-price relationships prevailing in 1949.

Self-propelled combines harvested an average of 388 acres per machine at an average total cost, excluding wages of the operator, of \$3.50 per acre, or about \$65 per 10-hour day. Interest and depreciation made up more than two-thirds of such costs. For machines harvesting only 100 acres each season, the overhead costs alone averaged about \$6 per acre, compared with only about \$2 for machines which harvested 500 acres. Thus, the amount of annual use is important to economical operation of combines. Operators who grow 200 acres or less of rice and who produce yields of about 12 barrels or less per acre, can hire their rice harvested at prevailing custom rates for less than the average cost of harvesting with their own combines.

Beef cattle raising on an extensive scale is a companion enterprise to rice on most southwest Louisiana farms. One mature animal uses about 4.5 acres of native grass pasture* with some rice stubble and additional feeds. Annual beef production, above herd replacement, averages about 200 pounds per brood cow, or some 40 pounds per acre of pasture. With improved pastures, one mature animal may be carried on each 1.5 to 2.0 acres and beef production per brood cow increased to an average of about 400 pounds. Depending upon stocking rates, production from improved pasture will equal 200 pounds or slightly more per acre.

Farmers are interested in making use of their idle rice land. The most common rotation used on rice farms is one year in rice and one or

*When cropland is left out of rice production wild grasses and similar vegetation appear voluntarily and furnish considerable grazing. In this report such land is generally referred to as "native grass" pasture. As related to rice production, these "rest" periods are essential to the control of noxious weeds and grasses and the maintenance of economical yields.

two years in native grass. Among the longer rotations that are being used is rice for two consecutive years and improved pasture for three or four years. Such rotations permit a smaller proportion of the cropland to be seeded to rice each year, but the improvement in yield per acre is sufficient to about maintain the same total volume of rice produced on the farm.

With a rotation of two years in rice and three years in temporary pasture, the average yield of rice is estimated at 16 barrels per acre compared with 12 barrels when the land is in rice one year and in native grass pasture each alternate year. With the "two-three" rotation, if improved pastures are established and properly maintained during the three years in which the rice is not seeded, the estimated average rice yields for the two following seasons is about 20 barrels per acre. Leaving the land in pasture for an additional year or for the fourth season would add about another barrel per acre to average yields. In addition to higher yields, there is some improvement in quality of the rice which, combined with the higher production of beef, gives substantially higher net returns to rice farmers.

With 1949 cost-price relationships the estimated net returns to labor, management, and land for a 400-acre rice farm, with one-half of the cropland in rice each year and either native grass or a combination of native grass and lespedeza pasture on the remaining half, were between \$5,500 and \$6,000. Estimated returns were about \$7,000 where rice is grown for two years and annual pasture crops for three years. The establishment of well-improved pastures on the land, when it was held out of rice for three years, gave estimated net returns of about \$11,600, and if the land was kept in improved pasture for four years after producing two crops of rice, the estimated returns to the operator were about \$11,000. For the rotation programs including the three and four years of improved pasture about a third of the gross receipts were derived from beef cattle.

Changes in prices received for rice and beef necessarily have varying effects upon the returns to the operator under the different rotation programs. Whereas changes in cattle prices have relatively little influence on the returns of operators using a rotation of one year in rice and one year in pasture, they have a greater influence on returns to operators following rotations of five to six years in length. However, the wider margin of returns to operators following rotations of two years in rice and either three or four years in improved pastures gives a decided advantage even at substantially lower prices for either rice or beef cattle.

Economic Appraisal of Farming Practices and Rotation Programs on Louisiana Rice Farms

TROY MULLINS¹

INTRODUCTION

During the last quarter of a century the rice industry of the United States has experienced an extraordinary growth. Responding to the need for greater food production during World War II, and to strong export demand and relatively favorable prices during later years, farmers had by 1953 more than doubled the production of rice compared with 1935-39. In 1953, the United States produced 52 million bags of rough rice. The average annual production in 1935-39 was 22 million bags.

The increase in Louisiana has not quite kept pace with that of the other rice producing states. During the 1930's Louisiana farmers produced about 40 per cent of the rice crop in the United States compared with about 23 per cent in 1953. But the production in 1953 in Louisiana was about 35 per cent higher than during the 1935-39 period. The increases were about 206, 162, and 175 per cent for California, Texas, and Arkansas, respectively. Before 1950, farmers in Mississippi planted little rice, but in 1953 they harvested about 1.7 million bags from 70,000 acres.

Although production of rice in the United States has more than doubled during the last 20 years, total domestic uses increased only 25 per cent (Figure 1). Per capita consumption was about the same in 1953 as during the 1935-39 period. Increases in domestic consumption have resulted from a larger population and from expanded industrial uses.

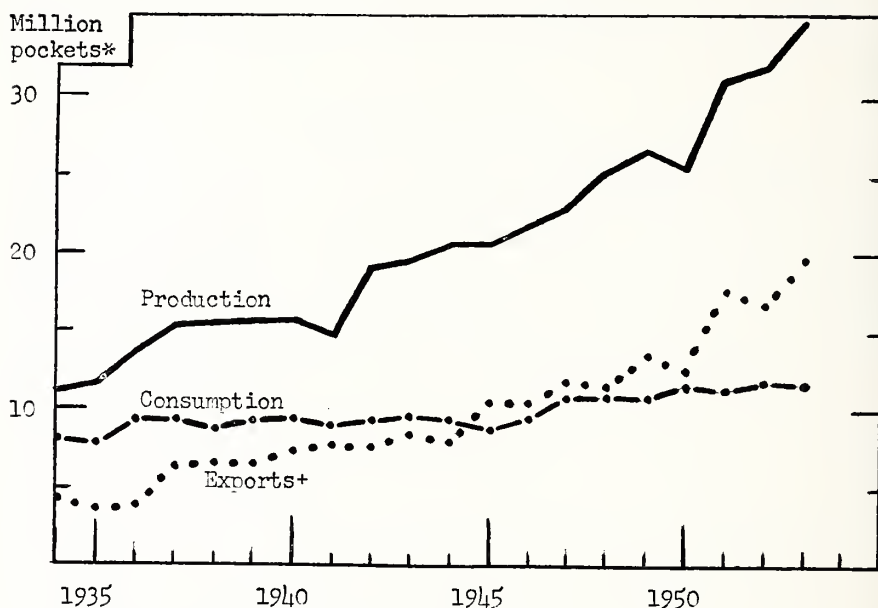
During recent years foreign markets helped to absorb the excess of United States production over domestic consumption. Exports and shipments, including military procurements, totaled about 19.5 million pockets in 1952-53.² This compares with an average of 14 million pockets for the last five years and of 5.3 million pockets for 1935-39.

Marked changes in the relative importance of various countries comprising our foreign markets, as well as in the importance of various pro-

¹Agricultural Economist, Agricultural Research Service, U.S. Department of Agriculture. The author expresses appreciation to the following individuals for helpful advice and criticism: Rufus K. Walker, Superintendent, and David E. Black and R. J. Miears, Agronomists in charge of pasture and rice fertilizer investigations, respectively, at the Rice Experiment Station, Crowley, Louisiana; Gilbert Martin, County Agricultural Agent for Jefferson Davis Parish; Eloï Primeaux, Soil Conservationist, SCS, Lake Charles, Louisiana; Professor J. Norman Efferson, Department of Agricultural Economics, Louisiana Agricultural Experiment Station; and E. L. Langsford, Agricultural Economist, Agricultural Research Service, U.S. Department of Agriculture.

²A pocket is equal to 100 pounds of milled rice.

Figure 1. United States Production, Domestic Uses and Exports of Milled Rice 1934-53.



Data from Agricultural Marketing Service.

*One hundred pounds of milled rice.

+Does not include military procurements, some of which were used in occupied areas.

ducing areas, have occurred in recent years. Reduced production in the Far East resulting from wars and associated adversities fostered a strong demand for United States rice in this general region. Although Cuba and some of the other countries in the Western Hemisphere still are important markets for our rice, local production in varying amounts has been established in these countries and some of the South and Central American countries may eventually become competitors of the United States in world markets.

In addition to changes in export markets and in competitive producing areas, which influence the future of Louisiana rice farmers, important developments in methods and practices used on farms have occurred. The combine has essentially displaced the binder and thresher. This has reduced labor requirements and alleviated the problem of recruiting large crews during the harvest season. But it has increased capital requirements and placed definite limits on the acreage of rice an individual operator must grow before ownership of a combine is economical.

Scope and Method of Study

This report contains: (1) a description of the present farming in the area, including labor, power, and materials used in producing rice, pasture, and beef cattle; (2) an analysis of the effect of various rates of application of fertilizer on yields and relative returns from rice; (3) information on the cost of irrigation water from wells equipped with various types of power units; (4) data on the cost of operating tractors, combines, and other farm machinery; (5) the effects of various rotations on the production of rice and beef; (6) a comparison of costs and returns from various systems of rice farming; and (7) an analysis of the effect of prices of rice and cattle on returns to farmers.

The information on which the report is based was obtained from a survey of a representative sample of 208 rice farmers in the 9 major rice producing parishes in Louisiana and from results of experiments conducted at the Rice Experiment Station at Crowley, Louisiana. Information on prices received for products sold and items and services purchased were obtained from published and unpublished reports of the Louisiana Agricultural Experiment Station and the Bureau of Agricultural Economics³ and from farm implement and supply dealers and others.

LOCATION AND DESCRIPTION OF LOUISIANA RICE AREA

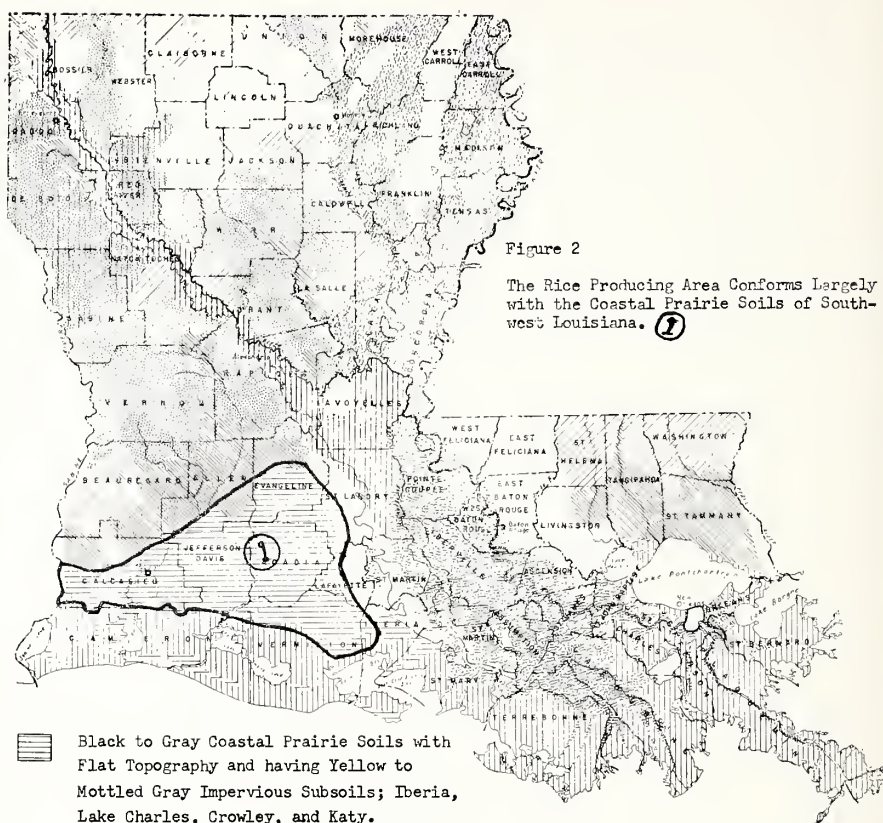
Rice is grown in 26 of the 64 parishes in Louisiana. However, about 95 per cent of the production in 1953 was in 9 southwest parishes, which comprise the area of primary concern in this study.

The rice area, originally prairie lands, is located just north of the marshes along the southwest Louisiana coast (Figure 2). The elevation ranges from sea level along the southern edge to about 60 feet along the northern boundary, a rise of about one foot per mile.

The top soils of the northern sections are moderately light in texture and are underlain with a relatively impervious clay subsoil. The Crowley, Acadia, and Landry silt loam series predominate. These soils respond well to fertilizer treatments and will produce other crops such as corn, cotton, small grains, and truck crops. However, it is only in the northeast corner and along the eastern edge of the area that these crops are grown to any extent. As a rule improved pastures are relatively easy to establish, although applications of phosphates generally are necessary.

The heavier soils, of which the Lake Charles clay series is the most prevalent, predominate along the southern edge of the rice area adjacent to the marshes and extend some distance inland. These soils are not well adapted to a variety of crops, and the principal uses are rice production and unimproved pastures. However, improved pastures are comparatively easy to establish. Although marked variations in productivity were noted, some of the better yields are obtained on the heavier soils. Seedbed preparation presents problems peculiar only to the heavy soils. Some farmers follow the practice of performing these operations under very wet condi-

³Now Agricultural Marketing Service.



tions, and water planting or seeding from planes is more common on the heavy soils.

The farms studied were classified, on the basis of the enterprise organization, into three general groups or type situations (Table 1). About a fourth of the farms were classed as rice-other crop farms. Most of these are located along the eastern and northern edges of the rice area. These farms had one or more cash crops in addition to rice. The other crops commonly grown include cotton, sweet potatoes, corn, oats, and lespedeza. The livestock, usually kept for home use, include poultry, hogs, and dual purpose cows. This is an area of small farms which are predominantly owner operated. Sixty per cent of the operators reported less than 80 acres of rice.

In the remainder of the area the farms reflect a high degree of specialization in rice and beef cattle production. Depending largely upon the tenure of the operator, these enterprises may or may not be combined under the same management. About 60 per cent of the survey farms where these enterprises were combined were operated by owners or part-owners; of the farms where rice was the only source of cash income, only 27 per

cent were operated by owners or part owners. The specialized rice farms averaged 317 acres, with 290 acres of cropland, and 175 acres seeded to rice. In comparison, the rice-beef cattle farms averaged 403 acres, with 356 acres of cropland, of which 185 acres were seeded to rice. The other acres of cropland on these farms provide pasture for the beef cattle herd.

PRODUCTION PRACTICES AND REQUIREMENTS FOR RICE

The texture of the soils and general drainage conditions have some influence upon the type of equipment used and the performance rates for the land preparation and rice seeding operations. In harvesting, the size of the combine and condition of the rice have much to do with performance rates. This discussion of rice field operations and practices is based on the most common types and sizes of equipment used on the farms studied, and the rates shown apply generally to the rice area. The different methods and resulting variations in performance rates attributable to varying soil conditions are not shown.

Field Operations

The usual operations from land preparation through delivery of the rice to dryers and the important facts related to each are shown in Table 2. Almost 4.5 hours of man labor, or about one-third of the total used in producing and harvesting an acre of rice, are required for land preparation, seeding, and levee building. Slightly more than 3 hours of the total of 3.7 tractor hours per acre are identified with these operations. The jobs of applying water, tending levees, draining fields, and reflooding are the most time-consuming of any of the various operations. More than one-half of the total man-hours required per acre are identified with these operations. This does not include the time required for tending wells where they are the source of irrigation water.

TABLE 1.—Distribution of Farms by Tenure of Operator and Size of Rice Enterprise, 208 Farms Classified by Major Farming Systems, 1949

Items	Rice and other crops	Rice and beef cattle	Special- ized rice	All farms
Number of farms	47	127	34	208
Acres per farm	286	403	317	362
	Per cent	Per cent	Per cent	Per cent
Tenure of operator:				
Owners	26	25	9	22
Part-owners	42	35	18	34
Share-renters	32	40	73	44
Total	100	100	100	100
Acres in rice:				
Under 80 acres	57	24	29	32
80 to 259 acres	30	57	45	49
260 or more acres	13	19	26	19
Total	100	100	100	100

Harvesting operations account for only 1.7 hours of man labor per acre, or about 12 per cent of the total of about 14 man-hours for all production and harvesting operations.

Variety Selection and Seeding Rates

Frequently farmers change the varieties of rice seeded. Factors contributing to marked shifts in varieties during the last decade are the change in method of harvesting, differences in milling quality, in the yield experiences with different varieties, and price differentials. A definite trend toward increased plantings of long grain varieties has prevailed during recent years. One-third of the 1953 acreage grown in Louisiana was seeded to long grain varieties and in 1952 these varieties made up

TABLE 2.—Usual Operations and Labor and Power Used in Producing and Harvesting Rice

	Date performed	Rate per day ¹	Times over	Time per acre	
				Man	Tractor
		<i>Acres</i>	<i>Number</i>	<i>Hours</i>	<i>Hours</i>
Seedbed and plant:					
Breaking	11/15- 3/1	12.5	1.3	1.00	1.00
Disking	1 /1 - 5/1	20.0	2.2	1.10	1.10
Harrow or drag ²	1 /1 - 5/1	37.0	1.2	.30	.30
Seeding	4 /1 - 6/15	30.0	1.0	.67	.33
Sub-total	— —	—	—	3.07	2.73
Levee building:					
Push up ³	4 /5 - 6/20	38.0	1.0	.52	.26
Plow drains	4 /5 - 6/20	71.0	1.0	.14	.14
Close ends and drains	4 /25- 7/15	6.7	1.0	.75	—
Sub-total	— —	—	—	1.41	.40
Irrigation:					
First watering	5 /1 - 7/1	6.6	1.0	1.52	—
Reflooding	5 /10- 8/15	12.1	3.0	2.49	—
Levee walking	5 /1 - 8/15	—	—	2.76	—
Draining	8 /15- 9/15	21.3	1.0	.47	—
Sub-total ⁴	— —	—	—	7.24	—
Weeding	7 /1 - 8/31	—	.3	.40	—
Pre-harvest total	— —	—	—	12.12	3.13
Harvesting: ⁴					
Combining	8 /10-11/31	18.8	1.0	.53	—
Carting to truck	— —	—	—	.53	.53
Hauling to dryer	— —	—	—	.53	—
Servicing combine	— —	—	—	.13	—
Harvesting total	— —	—	—	1.72	.53
Total for all operations	— —	—	—	13.84	3.66

¹Rate per 10 hours for one man or one unit of equipment.

²Includes separate operations only. Where harrow pulled behind disk no additional time allowed for this operation.

³Applicable to 7 ft. graders operated by 2 men. Two-fifths of all operators used disc plows, covering 27 acres per day or .37 man and tractor hours per acre.

⁴On the farms where binder method was used the usual harvesting crews were 2 men to operate binder, 4 men shocking rice, and about 20 men for threshing. An average of 10.7 man-hours per acre is required for harvesting with this method.

45 per cent of the acreage seeded. This compares with an average of only 13 per cent in long grain varieties during the 1935-39 period.

A few of the farmers surveyed grew as many as four or five varieties. However, 42 per cent grew only one variety and 37 per cent grew only two varieties. Zenith is the most common variety grown. It accounted for 46 per cent of the total acreage of rice on the farms surveyed, and 59 per cent of the 1953 acreage in Louisiana.⁴ Rexoro, a late maturing, long grain type, was grown on 22 per cent of the acreage surveyed. It is still an important variety in Louisiana. Bluebonnet, which in grain type is similar to Rexoro, has increased in importance in recent years.

A seeding rate of 100 pounds per acre was most commonly reported by the farmers surveyed. However, some farmers reported seeding the long grain varieties at a slightly lower rate.

Fertilizer Applications and Rice Yields

Slightly over 80 per cent of the operators used fertilizers on their 1949 rice crop. This practice is less common among the operators of small farms. Only two-thirds of the farmers growing less than 80 acres of rice used fertilizer, but about 75 per cent of the total acreage grown on these farms was treated. In comparison 95 per cent of the operators with over 260 acres of rice used fertilizer and about 87 per cent of the acreage on these large farms was treated.

The average application per acre for all farms was about 150 pounds. The most common analyses used, with the percentage which each comprises of the total tonnage applied on the farms surveyed, are: 4-12-4, 37 per cent; 5-10-5, 20 per cent; 0-14-7, 11 per cent; and 4-12-8, 9 per cent. The average pounds of plant food applied per acre treated were 6.8 pounds of nitrogen, 18.4 pounds of phosphate, and 7.2 pounds of potash.

Along with fertilizer treatments, differences in the productivity of soils and in rotation programs have an effect upon rice yields. Also yield variations are sometimes attributed to different varieties, although the importance of this factor may be over-emphasized.

About 82 per cent of the farmers seeded Zenith rice, and the reported yields for this variety were summarized for the purpose of observing any apparent relationship of rates of fertilizer applications to yields obtained. About 20 per cent of this group of farmers used no fertilizer and obtained an average yield of 11.7 barrels per acre; 50 per cent used 100 to 150 pounds and obtained 12.8 barrels; and the remaining 30 per cent used 175 pounds or more and obtained 13.3 barrels per acre. These differences in yields are small, but the plant nutrient applications were low to only moderate in all cases.

Per acre yield increases attributable to fertilizer applied at varying rates may be estimated more specifically from an analysis of experiments conducted over a period of years at the Rice Experiment Station and on farms throughout the area. A complete review of these data cannot be

⁴Summarized from statistics on varieties compiled by the Rice Millers' Association.

presented here, but the usual effects of fertilizers upon yields as indicated by this work are briefly noted.⁵

The yield effects of fertilizer treatments depend to a considerable extent on the type of soil to which it is applied and also on the previous uses and treatments which the land has received. In general, marked increases in yields are obtained when low to moderate applications of nitrogen (N) and phosphorus (P_2O_5) are made, and the yield effects per unit of application are successively smaller as more of these elements are applied. For example, when 20 to 30 pounds of nitrogen and/or phosphorus are applied, per acre yields will usually be increased by 1.5 to 2.0 barrels for each of these plant food nutrients, or a total of 3 to 4 barrels per acre when both are applied in these amounts. In the case of phosphorus, applications of more than 30 pounds usually result in comparatively small additional increases in yields, whereas for nitrogen appreciable yield increases are obtained at the 40 to 60 pound rates.

The effects of varying rates of nitrogen applied in or in conjunction with a complete fertilizer upon rice yields and estimated per acre net returns to farmers are illustrated in Table 3. A similar table applicable to phosphorus could be prepared but is not included in this report.

Net returns from the use of any given amount of fertilizer depend upon: (1) the yield response to various applications; (2) the price-cost ratio of rice and fertilizer, including the expense of application; and (3)

TABLE 3.—Estimated Effects of Fertilizer Treatments Containing Varying Amounts of Nitrogen on Per Acre Yields and Returns from Rice

Analysis of fertilizer applied ¹			Yield increase from each additional amount of N.					
			Total rice yield	Total	Per 12 pounds nitro- gen	Per pound ferti- lizer	Net value of added yield ²	Cost of additional ferti- lizer
N	P_2O_5	K_2O						
Lbs.	Lbs.	Lbs.	Bbls.	Bbls.	Lbs.	Lbs.	Dol.	Dol.
8	24	8	13.0					
20	24	8	15.8	2.8	38	8	17.92	2.40
32	24	8	17.7	1.9	26	5	12.16	2.40
44	24	8	18.9	1.2	16	3	7.68	2.40
56	24	8	19.7	.8	11	2	5.12	2.40
68	24	8	20.2	.5	7	1	3.20	2.40

¹The method and time of application of fertilizer is assumed to vary with the amounts of nitrogen. In these estimates, it is assumed that 8 pounds of nitrogen in a complete fertilizer is applied at seeding time, and the additional nitrogen in the higher rates (above that included in the complete fertilizer) is assumed to be applied as a topdressing after the rice has reached the desired stage of growth.

²The cost of hauling, drying, and storage for the increased production is subtracted from the price received for rice (\$7.00 less 60 cents) to give the net price or value (\$6.40 per barrel) of the increased production which is attributable to each additional 12 pounds of nitrogen applied.

⁵Detailed results of fertilizer studies are reported in the annual reports for the Rice Experiment Station, and in mimeographed reports released annually by the Crops and Soils Department of the Louisiana Agricultural Experiment Station.

the additional expenses incident to hauling, drying, and storing the increased production. Based on 1949 prices received for rice and costs of fertilizer it is shown in Table 3 that with 68 pounds of nitrogen the estimated increase in yield from the last 12 pounds would more than pay for the added fertilizer and associated costs. Because of the declining rate of yield increase at this level of treatment another 12 pounds would not, according to these estimates, bring farmers enough added income to more than offset the added costs. Thus assuming the estimated yield responses shown in Column 4 of Table 3 and the 1949 price-cost relationships, the 68-pound treatment of nitrogen approximates the maximum rate that is profitable to farmers.

With fertilizer costs remaining the same an increase in rice prices would permit some higher applications of nitrogen. But because of the declining yield response from higher treatments, the increase in applications that would be economical would be less relatively than the change in rice prices. On the other hand, somewhat lower applications, say 30 to 40 pounds, show a marked net return at the prices assumed, and would more than pay for the additional costs even with considerably lower rice prices.

It should be noted that the above calculations are based on estimated average yield responses generally applicable to the area. Marked differences in results of fertilizer treatments have been observed from experimental plots on varying soil types and locations within the rice area. Individual farmers should consult their local Extension Agents or the Rice Experiment Station for information on the desirable practices for their particular locality.

WATER COSTS

From 30 to 36 inches of water is needed for the average rice crop. The structure of the soil, the evaporation rate, and the care exercised by individual users influence the amount of water required. In the Louisiana rice area the average rainfall during the growing season is about 10 inches. Thus 20 to 26 inches needs to be applied through irrigation. However, variations in rainfall make it advisable to have irrigation facilities in excess of that needed during seasons of average rainfall.

The Louisiana rice area is irrigated from both surface and underground water. Large distributive canal systems service most of the farms using surface irrigation water. However, a few farms are conveniently located near streams and lakes, which are used as a source of water. The underground water is pumped from privately owned wells. The proportion of the rice acreage irrigated from each source varies from one season to another due largely to variations in surface supplies. In 1949 about 49 per cent of the rice acreage was irrigated with surface water, 43 per cent from wells, and the remaining acreage either received water from

both sources or the correct source could not be determined.⁶ Of the rice acreage included in this survey 52 per cent was irrigated with surface water and 48 per cent was served by wells.

The cost of irrigating rice is reflected either through the share of the crop that is paid for water, or in the investment and operating costs associated with pumping water from wells.

Because of the importance of irrigation from wells and because there are several types of well installations and power units, farmers are interested in the comparative costs of irrigation under various situations. Therefore, in this study, considerable attention has been given to well irrigation. Some of the more important variations in deep well installations that influence the costs of water are presented in Table 4. These data were summarized from a survey of 61 wells in 1949. Almost 50 per cent of the wells used natural gas as a source of power, and a little

TABLE 4.—Number of Wells and Kinds of Power Units, by Installation Dates, Size of Well and Power Units, and Acres of Rice Irrigated

Items	Kinds of power units				
	Natural gas	Diesel fuel	Butane gas	Electric motors	All wells -
	<i>Wells</i>	<i>Wells</i>	<i>Wells</i>	<i>Wells</i>	<i>Wells</i>
Number of wells	27	22	6	6	61
Installation date: ¹					
1946 or later	9	3	3	0	15
1941 — 1945	7	2	1	1	11
1936 — 1940	1	3	1	2	7
1931 — 1935	1	1	0	0	2
1930 or earlier	7	12	1	3	23
Size of well: ²					
8 inches	4	3	3	0	10
10 inches	21	15	3	4	43
12 inches	2	4	0	2	8
Power unit rating (H.P.):					
75 or less	1	0	0	5	6
76 to 125	13	11	4	1	29
126 to 175	10	8	2	0	20
176 to 225	2	2	0	0	4
226 and over	1	1	0	0	2
Acres of rice irrigated:					
100 to 149	3	2	3	2	10
150 to 199	4	2	1	3	10
200 to 249	8	6	2	0	17
250 to 299	6	4	0	0	10
300 to 349	3	2	0	0	5
350 and over	3	6	0	1	9

¹Installation date not determined for three wells.

²Diameter of the discharge.

⁶"Summary of Progress of the Water Resources Investigation in Southwest Louisiana," a progress report by the U. S. Geological Survey and the Louisiana Department of Public Works and Conservation.

less than 40 per cent used diesel fuel.⁷ About 40 per cent had been installed since 1940, and almost the same per cent were installed prior to 1931. The most common deep well is 10 inches in diameter, has a power unit ranging from 85 to 145 horsepower, and irrigates from 200 to 250 acres of rice.

One of the most important factors affecting the cost of irrigation water from a well is the kind of power unit used to operate the pump. To permit comparison, the cost of providing water has been calculated for four different kinds of power, assuming the same well installation and the same quantity of water supplied, that is, the same acreage of rice irrigation (Table 5). The basic information for these calculations was derived largely from the survey of 61 wells used to irrigate rice. In 1949 water costs were lower when an engine powered with natural gas was used than when an electric motor or engines that burned diesel or butane

TABLE 5.—Effect of Power Units on Pumping Costs

	Kinds of power units			
	Natural gas	Diesel fuel	Butane gas	Electric motors
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Installation costs: ¹				
Well and pump	6,461	6,461	6,461	6,461
Power unit	4,117	5,367	3,800	1,200
Total	10,578	11,828	10,261	7,661
Variable oper. costs: ²				
Fuel or power	546	1,279	1,365	1,463
Oil and lubricants	80	120	42	21
Annual repairs:				
Power unit	95	108	75	20
Pump	66	66	66	66
Belts	41	41	41	—
Sub-total	828	1,614	1,589	1,570
Fixed or overhead costs:				
Depreciation	471	574	444	169
Interest	168	199	150	95
Sub-total	639	773	594	264
Total cost per season	1,467	2,387	2,183	1,834
Cost per acre irrigated ²	6.52	10.61	9.70	8.15

¹Based on 10-inch wells with power units ranging from 125 to 150 horsepower except electric motors which run from 60 to 75 horsepower.

²Average well furnishes water for about 225 acres of rice and is pumped about 65 round-the-clock days. 1949 prices used in cost calculations.

⁷A summary of types of fuel or power used for irrigation that was made in 1951 by the U. S. Geological Survey, Ground Water Division, which included 1,061 wells, showed that 42 per cent were powered with distillate or tractor fuel, 20 per cent with natural gas, 10 per cent with electricity, 4 per cent with butane gas, and 2 per cent with gasoline. The kind of fuel was not determined for 14 per cent of the wells. (*Geology and Ground-Water Resources of Southwest Louisiana*, Louisiana Department of Conservation Geological Bul. 30, Table 11.)

were used. The estimated water costs, assuming a 10-inch well that supplies water for 225 acres of rice, are \$6.52, \$8.15, \$9.70, and \$10.61 per acre for natural gas engines, electric motors, butane gas engines, and diesel engines, respectively. These costs do not include expenses incident to spreading the water. Fuel costs for operating natural gas engines are much lower than for the other types of power units and account for most of the difference in total costs. The comparatively low original costs and the longer life of electric motors resulted in relatively low overhead costs for these power units.

Factors other than costs of operation often influence farmers in the choice of power units. For example, some farmers expressed a preference for fuel engines because they can be throttled down from full load operations, thus regulating the volume pumped to conform with the water requirements at different growth stages of the rice crop. Electric motors are not adaptable to this condition. Also, fuel burning units are available for use at any time during the off season, whereas off season use of electricity generally requires special arrangements with utility companies. On the other hand electric motors require a minimum of daily attention, a convenience often mentioned, and when repairs are necessary their general cleanliness is a consideration in their favor.⁸

As indicated earlier, most of the surface water used on rice is supplied by canal companies to the individual farmer in return for a fifth share of his crop. Thus the annual cost of water to these growers depends upon the yield and price of rice. Each grower who pays a share of his crop for water can compute the per acre value of such payments and compare it with the estimated costs of pumping water as shown above.

MACHINERY REQUIREMENTS AND COSTS

For the most part rice production operations are highly mechanized and large amounts of capital are required. The investment in power and equipment, exclusive of well installations, averages about \$75 per acre of rice. A large part of this investment is in tractors and combines.

Tractors

Slightly more than 90 per cent of the farmers surveyed owned from one to five tractors, the usual number being two tractors per farm. The average acres of rice per tractor was 92, and ranged from 44 acres per tractor on farms with less than 80 acres of rice to 136 acres per tractor for farms with more than 260 acres of rice. About 70 per cent of the tractors were four-plow units and most of the others were three-plow units. About 40 per cent had been used two seasons or less, and 60 per cent had been used no more than six seasons. The estimated life of tractors averaged 12 years.

Tractor operating costs are summarized in Table 6. Tractor fuel or distillate is the common tractor fuel used in the rice area. The usual rate

⁸Some additional information on the cost of electricity for pumping during the 1951, 1952, and 1953 seasons is shown in Appendix Table 7.

TABLE 6.—Usual Cost, per 10 Hours, for Operating Standard 4-Plow Tractor in the Rice Area

	Used	per 10 hours	Cost per
	Unit	Quantity	10 hours ¹
			<i>Dollars</i>
Fuel and lubricants:			
Tractor fuel	Gallons	40	5.08
Oil	Quarts	2.7	.50
Gasoline	Gallons	1	.16
Grease			.12
Total			5.86
Other costs: ²			
Repairs ³			1.71
Interest ⁴			.48
Depreciation ⁵			1.63
Total other costs			3.83
Total operating and overhead			9.69

¹Based on 1949 prices.

²Annual charges computed on 10-hour day based on an average of 89 days of use per year.

³Tractors overhauled each two years at an average cost of \$193. Half of overhaul costs plus miscellaneous repairs averaging \$56 gives annual repairs of \$153 per season.

⁴Interest computed at 5 per cent on one-half of original cost, which averaged \$1,735 per tractor (\$43 annually).

⁵Tractors depreciated over 12-year period on straight line basis (\$145 annually).

of consumption for most field operations with a standard four-plow tractor is 4 gallons per hour. Crankcase oil requirements averaged 2.7 quarts per 10 hours, and the total cost of fuel, oil and grease averaged about \$6 per day. When used 890 hours annually the cost of repairs and interest and depreciation averaged about \$4 per 10-hour day, making a total operating and maintenance cost of nearly \$10 per day.

Combines

Thirty-six per cent of the farmers either owned or shared the ownership of combines with other farmers. An additional 29 per cent hired the services of combines. Thus 65 per cent of the operators used combines in harvesting their rice. In 1949, 78 per cent of the rice grown on farms included in this survey was harvested with combines. Louisiana rice farmers have shifted more completely to the use of combines since the 1949 season and probably as much as 95 per cent of the 1952 and 1953 crops was harvested by this method.

Detailed costs of operating self-propelled combines are shown in Table 7. The 12-foot self-propelled type is used almost exclusively and the machines included in this survey harvested an average of 388 acres per machine. Gasoline is the common fuel used by combine motors and the average hourly consumption is about 4 gallons. The total cost of fuel, oil, and grease per machine for the season averaged \$150, and annual repairs

Table 7.—Average Annual Costs of Owning and Operating 12-foot Self-propelled Combines¹

Items	Dollars
Operating costs:	
Gasoline	129.00
Motor oil and bearing grease	21.00
Repairs	279.00
Sub-total	429.00
Fixed costs:	
Depreciation ²	776.00
Interest	129.00
Sub-total	905.00
Total costs ³	1,334.00
Costs per acre harvested ⁴	3.44
Costs per 10-hour day	64.67
Total costs for combine and grain cart ⁵	1,402.00
Costs per acre harvested	3.61
Costs per 10-hour day	67.87

¹Based on operating statements for 64 machines which harvested slightly over 26,000 acres of rice. Four machines harvested from 100 to 200 acres, 11 from 200 to 300 acres, 28 from 300 to 399 acres, 11 from 400 to 499 acres, and 10 machines harvested over 500 acres. The average for all machines was 388 acres.

²Original cost of machines averaged \$5,170, and the estimated life averaged 6.7 years.

³Does not include wages of operator.

⁴Based on an average of 388 acres harvested per machine and an average performance rate of 18.8 acres per 10 hours.

⁵Includes annual costs of \$68 for grain cart (repairs, \$10; depreciation, \$40; and interest, \$18). A grain cart is required for each combine which operates in separate fields, but may serve more than one machine when operated together. Does not include charge for tractor pulling the grain cart.

averaged about \$280. Depreciation and interest averaged about \$900 per machine, making a total for the season of \$1,330 excluding operator labor. This is about \$65 per day operated, or \$3.44 per acre of rice harvested.

An additional annual cost of about \$70, mainly depreciation and interest, is required for each grain cart used to haul rice from the combine. Generally a grain cart is needed for each machine, but where two or more combines are operated in the same field it is possible to serve more than one combine with each grain cart. No allowance is made in Table 7 for the costs of the tractor required to pull the grain cart.

About 70 per cent of the cost of owning and operating a combine and grain cart is attributable to depreciation and interest charges which do not vary proportionately with the annual use. Farmers are aware of the importance of using combines at relatively full capacity and have extended their use through joint ownership and/or custom harvesting for other farmers. The relationship of the amount of annual use to the average cost per acre of operating combines and grain carts is shown in Table 8. The acres harvested annually are assumed for illustrative pur-

poses, and adjustments were made in the depreciation rates where the machines were not used at relatively full capacity.

Estimated total costs per acre are about \$7 when the annual use is 100 acres per machine. At this level of use, fixed costs make up about 84 per cent of the total cost of using combines. The total per acre costs are reduced to about \$3 when 500 acres are harvested annually, and about 64 per cent of the total is attributable to depreciation and interest.

Operators of small farms can hire the use of combines at standard custom rates. The number of machines available for custom work is sufficient that the risk of getting a small acreage harvested at the desired time is not serious. Thus by comparing the cost of using custom machines with the cost of owning a combine, operators can determine the conditions under which it is desirable to buy a combine. The acreage of rice grown and average yield produced are important factors in each individual situation.

Calculations which should prove helpful in arriving at such a decision, assuming average operating costs and performance rates for combines and yields varying from 10 to 18 barrels per acre, are shown in Table 9. With an average yield of 10 barrels it would cost the operator \$6 per acre to hire his rice harvested. To the owner of the equipment the total direct operating costs for the combine, the tractor for the grain cart, and the wages of the combine and tractor operators would average about \$2.50 per acre. This leaves \$3.50 per acre of the \$6 custom charge which may be credited to fixed or overhead costs. At this rate of earnings (\$3.50 per acre) above direct operating costs a minimum of 275 acres must be harvested each year to cover the annual depreciation and interest charges and thus make ownership of a combine as economical as custom harvesting at 60 cents per barrel.

As the average yield increases, the per acre custom charges rise and, assuming that the direct operating costs per acre remain approximately the same, a larger amount is available to cover fixed costs. Thus, if the

TABLE 8.—Effects of Total Acres Harvested on Per Acre Cost of Operating Combines and Grain Carts, 1949 Prices

Acres harvested per season	Total cost per acre ¹	Proportion attributable to	
		Fixed costs	Variable costs
	<i>Dollars</i>	<i>Per cent</i>	<i>Per cent</i>
100	7.11	84	16
200	4.63	76	24
300	4.34	74	26
400	3.54	68	32
500	3.06	64	36
600	2.72	59	41

¹Total costs computed in same manner as shown in Table 7, except depreciation of combine adjusted in relation to acres harvested: 8 per cent for 100 acres; 10 per cent for 200 acres, and 15 per cent for 300 acres or more. Interest at 5 per cent on one-half the original cost and no wages included for machine operator.

operator uses 60 cents per barrel in figuring the cost of combining, the production of above average yields makes it economical to own a combine with a smaller total acreage to be harvested each year. For example, with an average yield of 18 barrels the per acre custom cost would be \$10.80, of which \$8.30 could be credited to fixed costs. In this case, it is necessary to harvest only about 116 acres annually to make ownership of a combine as economical as the payment of prevailing custom rates.

The above calculations do not take into account the fact that by owning a combine the operator is provided an opportunity for self-employment in harvesting his own rice, whereas this is not the case if he uses custom machines. If on-farm work represents the principal opportunity for employment, this consideration would be of some importance in his decision. However, if the farm operator can obtain off-farm work, the opportunity costs may more than offset the wages he could earn by operating his own combine.

Other Equipment

The principal items of equipment other than tractors, combines, and grain carts are the farm pick-up truck, the one-and-one-half ton trucks, and various land preparation, levee building, and seeding equipment. Just as the number of tractors varies with the size of farms and the rotation program followed, so do most of these items. Inventories of the usual number and investment in these machines for a representative medium sized farm operated with different rotation plans are shown in Appendix Tables 4 and 5.

Practically all rice farmers have a pick-up truck for general farm use. The operators of medium and large farms who own harvesting equipment generally have large trucks for hauling grain to dryers. The investment in trucks generally is equal to 60 to 70 per cent of the amount

TABLE 9.—Effects of Rice Yields on Per Acre Custom Harvesting Costs and on the Minimum Acreage Required for Economical Ownership of Combines

Yield per acre	Cost of custom harvesting per acre ¹	Per acre net returns for use of combines ²	Annual use re- quired to cover fixed costs ³
<i>Bbbs.</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Acres</i>
10	6.00	3.50	275
12	7.20	4.70	205
14	8.40	5.90	163
16	9.60	7.10	136
18	10.80	8.30	116

¹Computed at 60 cents per barrel and covers cost of the grain cart and tractor to deliver the grain to trucks and the wages of the combine and tractor drivers.

²Per acre costs shown in Column 2 less \$2.50 required for all direct operating costs. This includes \$21.24 per day for fuel, oil, and repairs for combine and grain cart (annual operating costs shown in Table 7 adjusted to daily rate); \$9.69 per day for tractor to pull grain cart (from Table 6); and \$8.00 each for the tractor driver and combine operator; or a total of \$46.93 divided by the average performance rate of 18.8 acres per 10-hour day.

³Total annual fixed costs for combine and grain cart as shown in Table 7 (\$963) divided by per acre net returns in Column 3.

invested in tractors, except on the large farms with three or more tractors, where the proportionate investment for trucks is less.

The amount of land preparation and miscellaneous equipment owned is directly related to the acres of rice grown and to other uses of land that require machines for special treatments. Since the number of tractors required is also related to these factors, it is convenient to associate the capital requirements of such equipment with the numbers and investment in tractors for a given farm. Normally the investment in miscellaneous equipment is equal to about 50 per cent of the investment in tractors. Total annual repairs for these items usually average from \$250 to \$300 per tractor included in the equipment inventory.

PRODUCTION PRACTICES AND REQUIREMENTS FOR BEEF CATTLE AND PASTURE

Both climatic conditions and the usual rotations followed on rice farms in this area are conducive to cattle raising. Beef production has been a companion enterprise to rice for much of the area, which presently supports a relatively large cattle population. This report is concerned primarily with the specialized rice-cattle producing area and treats only this enterprise in addition to rice.

Except during excessively dry periods, the land that "rests" for one or two seasons between rice crops produces considerable grazing from April to October. During fall and winter months, the straw and volunteer growth from recently harvested rice fields provide the major feed supply. Thus, some grazing is available through the year. Except during occasional winters a minimum of supplemental feeding is necessary. Unfavorable weather, either during the summer or winter months, is soon reflected in reduced rates of production. Most severe losses occur during excessively cold and rainy winters. Farmers could avoid heavy losses by maintaining a reserve supply of feeds and providing shelter from wind and rain during such emergencies.

Beef Cattle Practices

Maintenance of brood cows and the sale of calves at 6 to 8 months is the most common practice among cattle owners in the rice area. The extensive nature of their operations is reflected in the usual stocking rates and general management practices. Stocking rates on the farms surveyed ranged from one mature animal for each 3.5 to 6.5 acres of land in pasture, most of which is unimproved or native grass, and averaged one to about 4.5 acres. Usual production rates, feeding practices, and related information on the cattle enterprise are shown in Table 10. Farmers estimated that 63 per cent of the cows of breeding age produced calves each season. Calves sold during 1949 averaged 330 pounds each. Assuming that 63 per cent of the brood cows produced calves of average weight, the production per brood cow averaged about 208 pounds of beef.

Present feeding practices are variable with respect to periods of feeding, kinds of feed, and daily rations given. Most farmers feed some during January and February, and some start feeding in December. Some feed concentrates to the weaker animals only. The cattle on surveyed farms received an average of 100 pounds of concentrates, 533 pounds of hay and straw, and 30 pounds of cottonseed hulls per mature animal during the winter of 1949.

Improved Forage Production

A great deal of interest has developed among farmers in increasing the carrying capacity of pastures as a means of increasing beef production, and because of the beneficial effects of such practices in producing higher rice yields. In general, efforts have centered around seasonal grazing crops which are available during critical periods of need and in the establishment of improved pastures for longer periods of grazing.

Supplies of palatable forage from native grasses and the aftermath of the rice crop are the shortest during the dry summer months and during the three winter months. Kobe lespedeza has been found to be a practical summer grazing crop for the rice area. It may be seeded with good results under widely varying situations as to previous crops and seedbed conditions. Furthermore, where the land is idle for more than one season, it reseeds itself each year, except during years when several late spring freezes occur.

TABLE 10.—Usual Production Factors, Feeds, Miscellaneous Supplies, and Labor for Beef Cattle¹

Items	Unit	
Average size of herds:	Number	54
Cows, 2 years or over	"	48
Heifers, 1 to 2 years	"	5
Bulls	"	2
Production factors:		
Normal calf crop ²	Per cent	63
Average weight of calves sold	Pounds	330
Calf production per cow ³	"	208
Death loss among brood cows	Per cent	3
Cows replaced annually	"	12
Feeds, labor, and supplies per animal unit:		
Concentrates:		
Cottonseed cake and other protein feeds	Pounds	48
Rice bran	"	42
Grains	"	10
Roughage:		
Hay and rice straw	"	533
Cottonseed hulls	"	30
Veterinary fees and misc. supplies	Dollars	1
Labor	Hours	7

¹Summarized from records covering 40 beef cattle herds, in 1949.

²Ratio of calves raised to cows of breeding age.

³Total calves times 330 pounds divided by the number of mother cows.

Several winter growing crops are adapted to the soils and climatic conditions of the rice area and produce forage during December, January, and February. Oats and wheat grow well on the lighter textured soils of the northern and eastern sections, when proper surface drainage is provided, and both have been used by a few farmers. Rye grass also grows well on the lighter textured soils and is more commonly used for winter grazing.

During recent years, improved pasture for year-round forage production has received intensive study at the Rice Experiment Station and in outlying field tests. Farmers are showing more interest in the findings of these studies each year. Results of this research indicate that, for much of the rice area, good results can be obtained from mixtures of Dallis grass, Bermuda grass, White Dutch clover, and Kobe lespedeza. Such mixtures produce a stable supply of forage for a long grazing period each year.

Some farmers expressed a preference for using no more than two of these pasture plants in mixtures. The adverse effects attributable to competitive growth habits, as well as the more simple practices required for establishment when fewer species are used, seem to explain such preference. In such instances White Dutch clover and Dallis grass are generally seeded together. Native Bermuda grass and lespedeza comprise another common mixture. The use of either of these mixtures provides reasonably adequate grazing except during the winter months. Very good results have been obtained when each of these mixtures is established on separate pastures and the cattle rotated in accordance with pasture conditions and needs of the animals.

Proper seedbed preparation is important, particularly in seeding improved pasture mixtures for which the initial costs are relatively high. Proper surface drainage and the application of ample fertilizer are essential to good results. A common fertilizer treatment in establishing pastures is the application of 300 pounds of a 3-12-12 mixture per acre.

Because of the competition for labor and power between land preparation for fall seeded pastures and the rice harvest, and because of the difficulties frequently encountered with inadequate soil moisture, the practice of overseeding⁹ certain pasture crops on rice stubble without any land preparation has been followed in recent years. This practice is particularly practical for rye grass or white clover seeded immediately after the rice harvest. Seeding of lespedeza on rice stubble during February and March is also a common practice in the rice area. For success with this practice, the levees for the previous rice crop should be cut at frequent intervals, and sufficient furrows run to provide adequate surface drainage.

⁹Refers to the broadcasting of grass seeds over the rice stubble. A great deal of this is done with airplanes at custom rates. A few farmers overseed white clover on the maturing rice crop to take advantage of the abundant moisture in the soil immediately after the irrigation water is drained off.

Information relating to the establishment and use of the various pasture crops is presented in Table 11. This information should be helpful to farmers in deciding which of the individual pasture crops or combinations of crops will best supplement the present forage production, in determining the proper seeding dates and rates, the fertilizer treatments that generally are necessary for the establishment of each kind of pasture, and in appraising the additional grazing that might be expected. Conditions on an individual farm may necessitate variations from the general requirements indicated in this table.

Beef Production from Improved Pastures

The benefits from improved pastures are reflected in increased stocking rates and beef production per acre. The approximate stocking rates that would be practical and estimated beef production¹⁰ with various pasture programs are shown in Table 12. These pasture programs reflect varying degrees of improvement over the use of native grass produced on land that is resting from rice for one or more seasons. They are representative of adjustments in pasture programs that some farmers are now making. The estimates shown in Table 12 were established after analyzing available experimental results, and after conferring with informed individuals in the area. The beef production from the improved pastures reflects some benefits from more adequate supple-

TABLE 11.—Seeding Requirements, and Estimated Grazing from Various Pasture Crops Adapted to the Rice Area

Kinds of pasture	Seeding dates	Seed per acre	Grazing dates	Animals per acre ¹	Animal unit months per acre
		<i>Lbs.</i>		<i>Number</i>	<i>Number</i>
Seasonal pastures:					
Native grasses	—	—	4/1 -10/1	.20	1.20
Rice stubble	—	—	9/15-12/15	.25	.75
Lespedeza	2/15- 3/15	25	5/15-10/5	.70	3.50
Rye grass	9/15-11/1	25	1/15- 5/15	.70	2.80
Rotation mixtures:					
Dallas grass and		12			
White Dutch clover	10/1 -11/15	⁵	2/15-10/15	.80 ²	6.4
Lespedeza and		25			
Bermuda grass	2/15- 3/30	³	5/15-10/15	.80	4.4

¹Carrying capacity or stocking rate applies to number of animals one year old or over. Lespedeza and rye grass treated with 300 pounds of 0-14-7 at seeding, and rotation mixtures receive annual treatments of 300 pounds of 3-12-12.

²White clover generally furnishes some grazing as early as Dec. 15, but the stocking rate could only run about half this number prior to Feb. 15.

³Bermuda grass not seeded as it comes in volunteer in most areas.

¹⁰In this report, beef production refers to the increase from the herd that is available for market each season. It is determined by multiplying the number of calves raised less replacement reserves by the estimated weight of calves sold, plus the estimated weights of breeding animals sold each year.

TABLE 12.—Estimated Stocking Rates and Beef Sales Per Acre with Various Pasture Programs

Unit		Pasture programs				
		Native grass	Lespedeza-native grass	Lespedeza and rye grass	Imp. pasture	
					Two-three ¹	Two-four ¹
Proportion of pasture in:						
Native grass	Per cent	100	33	—	—	—
Lespedeza	Per cent	—	67	60	32	25
Rye grass	Per cent	—	—	40	—	—
Imp. mixtures	Per cent	—	—	—	68	75
Total		100	100	100	100	100
Pastures: ²						
Per animal unit	Acres	3.8	2.1	1.8	1.4	1.3
Per brood cow	Acres	5.6	3.0	2.6	2.1	1.9
Feed per animal unit:						
Concentrates ³	Lbs.	40	80	130	130	130
Roughage ⁴	Lbs.	250	450	750	750	750
Rice stubble	Acres	3.2	1.9	1.2	1.1	.7
Per cent calf crop	Per cent	63	63	80	80	80
Estimated average weight of calves	Lbs.	300	350	375	450	450
Beef sales:						
Per cow ⁵	Lbs.	238	259	342	400	400
Per acre ⁶	Lbs.	43	87	129	192	212

¹Refers to length of rotation cycle; namely two years in rice and three or four years in pasture. These rotation programs are discussed in the following section of this report.

²Excluding rice stubble and a limited acreage of lespedeza from which hay is harvested. Calves and yearlings counted as one-third and two-thirds animal units, respectively, and all animals two-years and over counted as one animal unit regardless of weight.

³Cottonseed cake or meal equivalent. Three pounds of rice bran assumed to equal 2 pounds of meal.

⁴Lespedeza hay equivalent. Rice straw and cottonseed hulls converted to lespedeza hay equivalent at rate of two to one.

⁵Includes cull breeding animals as well as calves sold.

⁶Applicable to land in pasture, excluding rice stubble and lespedeza acreage from which hay is harvested.

mental feeding and related management practices, which generally are associated with the use of improved pastures. No attempt was made to separate the influence of these factors from the benefits specifically attributable to improved pastures.

Through pasture improvements, stocking rates can be increased from about 25 animal units per 100 acres of native grass pasture to around 75 units for each 100 acres comprised of a balance between improved pasture mixtures and seasonal grazing crops. With the improved carrying capacity, a higher percentage of brood cows raise calves, and to heavier average weights; thus the marketable beef from the herd is increased by a larger percentage than the change in stocking rates. Estimated production per brood cow averages about 238 pounds for native grass pas-

tures, or some 40 pounds per acre, compared with an estimated 400 pounds per cow, or about 200 pounds per acre, with the improved pasture mixtures and with some additional supplemental feed during the winter season.

COMPARISON OF RICE FARMING SYSTEMS

High capital requirements and cash outlay associated with rice production emphasize the importance of efficiency in general farming practices and of full utilization of land and other resources. To a considerable extent, production of rice from a given acreage depends upon the uses of, and accompanying treatments applied to, the land between rice crops. Therefore the entire farming system must be considered in evaluating the production and income possibilities from rice farms.

Rice accounts for 85 per cent of the harvested crop acres in about 80 per cent of the area. For each acre in rice, about one and one-half acres are "rested" each year from rice production. This idle land is grazed with beef cattle. The soils of the rice area are variously adapted to the production of grazing crops, and farmers recognize such conditions in planning their rice and pasture programs. Factors other than adaptability of the soils, such as tenure of the operator or the available capital resources, often have a great deal to do with the choice of enterprises and the intensity of cultural treatments.

In this section, some of the more common rotations used on rice farms are discussed and analyzed. Also other rotations, representing feasible adjustments from the usual ones and which are considered well suited to certain localities and production situations, are presented for comparison with the more common ones. The objective is to evaluate the relative operating efficiency when farms are organized according to different rotation programs and utilizing different kinds of pastures and land treatments. Experimental results accumulated over the past several years and pertaining to similar pasture programs and land treatments were drawn upon in estimating applicable production rates for the various rotation programs. A medium-sized farm of 400 acres of cropland is used as a working model in comparing operator returns for these farming systems.

Crop Rotations in Rice Farming

Crop rotations are receiving increasing attention among rice farmers. Accumulation of noxious weeds and the marked decline in yields with continuous seeding to rice indicate that land should be allowed to "rest" from rice production. Farmers are finding that only moderate pasture treatments are needed to materially increase the carrying capacity and the production of beef from this land.¹¹ Such practices also result in increased yields and improved quality (reduced red rice and weed seed) of subsequent rice crops. Furthermore, the attention required for estab-

¹¹See discussion of pasture improvement and beef production in an earlier section.

lishing and maintaining improved pastures, and for the larger beef cattle numbers which they will afford, permits fuller use of the year-round labor force and power.

The cropland organization, associated yields, and gross production for the rotation programs analyzed in this report are shown in Table 13 for a farm of 400 acres of cropland. The variations in estimated yields and production rates for rice and beef cattle are due largely to the length of the rotation, and to land treatments carried out in connection with the pasture programs.

The most widely used cropping plan is one year in rice and one year in native grass. This program is shown in Table 13 as the one-one rice-native grass rotation.¹² Depending on location within the area, rice yields average about 10 to 12 barrels when this program is followed, and the stocking rate for beef cattle averages about one mature animal to each 4 to 5 acres of idle rice land.

This system may be modified by seeding lespedeza on a part of the land during the years it is resting from rice and by applying a moderate quantity of fertilizer. The lespedeza competes effectively with weeds, which otherwise are unhampered, and provides forage for more cattle. Under the one-one rice-lespedeza pasture rotation, when only about half of the idle land is seeded to lespedeza, the estimated yield of rice is one barrel per acre more than when all of the land is left in native grass. But the stocking rate is increased to about one mature animal to each 2.3 acres of land not in rice.

Increasing benefits are derived from the pasture program if the rotation cycle is extended and pasture crops which provide forage for a longer period of the year are included. Seasonal grazing crops such as lespedeza and rye grass are sometimes used as the principal source of forage on farms organized according to this general rotation plan. Some farmers have used these grazing crops on land that is left out of rice for two years after each rice crop. However, for comparison in this report, a rotation program of two consecutive years in rice and three years devoted largely to seasonal grazing crops is included. This rotation plan is referred to in Table 13 as the two-three rice-temporary pasture program. Somewhat less capital investment is needed for this plan compared with rotations which include a well-improved pasture-beef cattle enterprise. Under this program, it is estimated that the longer "rest" period from rice would result in average yields of about 16 barrels per acre, and the stocking rate could be held at about one mature animal to each 2.3 acres in pasture.

¹²In this report, the following shortened terms will be used in referring to various rotation programs: one year in rice and one year with the unseeded land grazed with beef cattle as one-one rice-native grass; one year in rice and one year in lespedeza as one-one rice-lespedeza pasture; two years in rice and three years in annual grazing crops as two-three rice-temporary pasture; and two years in rice and three or four years in improved pasture as either two-three or two-four rice-improved pasture rotations.

TABLE 13.—Cropland Organization and Production for Selected Rotation Programs on a Medium-sized Rice Farm

Items	Unit	One-one rice- native grass	One-one rice- lespedeza pasture	Two-three rice- temporary pasture	Two-three rice- improved pasture	Two-four rice- improved pasture
Cropland use:						
Rice	Acres	200	200	160	160	133
Native grass	Acres	200	75	0	0	0
Lespedeza ¹	Acres	0	125	140	80 ²	67 ²
Rye grass ¹	Acres	0	0	100	0	0
Imp. pasture ¹	Acres	0	0	0	160	200
Total	Acres	400	400	400	400	400
Beef cattle	Number	48	86	104	126	155
Production per acre:						
Rice ³	Barre's	12	13	16	20	21
Beef ⁴	Pounds	43	87	129	192	212
Total production:						
Rice	Barre's	2,400	2,600	2,560	3,200	2,793
Beef ⁵						
Calves	Pounds	5,400	12,110	20,250	29,700	36,450
Mature animals	Pounds	3,160	5,250	7,080	10,065	11,490

¹Fertilizer treatments and other requirements associated with the establishment and annual maintenance of pastures shown in Appendix Table 2.

²Rye grass for winter grazing precedes lespedeza on most of this acreage. For each of the longer term rotation programs (two-three and two-four) a limited acreage of lespedeza is cut for hay.

³Annual per acre fertilizer treatments assumed are 200 pounds of 4-12-4 for the one-one rice-native grass rotation and the one-one rice-lespedeza rotations, 200 pounds of 5-10-5 for the two-three rice-temporary pasture rotations, and 65 pounds of 33 per cent am. nitrate for the two-three rice-improved pasture and the two-four rice-improved pasture rotations.

⁴Applies to acres not seeded to rice less acreage from which lespedeza is harvested for hay. Assumes feeding rates, etc. shown in Table 12 and discussed in the section on pastures and beef cattle.

⁵Indicates estimated gross weight of animals available for market each season. (Calves in excess of replacement requirements plus cull breeding animals sold each year. See footnote Page 28.)

A further increase in the annual production of beef and rice from this farm can be made if an improved pasture-rice rotation program is followed. Improved pastures as used in this report refers to the use of two or more pasture plant species grown on the same land for more than one season and which under normal moisture conditions furnish grazing for several months during the year.¹³ Such pastures usually are somewhat more expensive to establish than are seasonal or temporary pastures and generally they do not reach full production within the first year after seeding.

Considerable research at the Rice Experiment Station and on outlying farms has been carried on with a two-three rice-improved pasture program,¹⁴ and the estimated stocking rates and rice yields shown in Table 13 for this program are based largely on the results of this work. It is estimated that one mature animal could be maintained the year

¹³These pasture mixtures were discussed on pages 22 to 24 and the estimated carrying capacities are shown in Table 11.

¹⁴See Louisiana Agricultural Experiment Station Bulletin 407.

round for each 1.6 acres of pasture and that rice yields would average about 20 barrels per acre.

The various rotation programs discussed thus far permit from 40 to 50 per cent of the cropland to be seeded to rice each year. Maintaining these proportions of their land in rice may not be so important to some farmers. Particularly would this be true, in the future, if acreage restrictions should be imposed upon rice farmers. Consequently, in connection with our comparison of rotation programs, it is of interest to consider the effects upon operator returns of growing rice only on a third of the cropland and of utilizing the remaining two-thirds with a well-improved pasture-beef cattle enterprise. This program is referred to in Table 13 as the two-four rice-improved pasture program. The kinds of pasture crops and the land treatments are the same as assumed for the two-three rice-improved pasture program, the only change being that the established pastures are grazed for four seasons rather than three. With this rotation program the average rice yield is estimated at 21 barrels per acre. Stocking rates for the "two-four" rotation are about the same as for the "two-three" rotation but since a larger acreage is used for pasture, a somewhat larger farm herd can be maintained.

Estimated Returns from Alternative Rice-Cattle Rotations

A comparison of estimated net income to the farm operator provides a good basis for evaluating alternative systems of farming. Receipts, expenses, and net returns for the selected rice-cattle rotations previously described are summarized in Table 14. They are based on the crop yield data, beef production rates, and labor, power, seed, and fertilizer requirements discussed in earlier sections. Also, the applicable experimental results for rice and pastures have been included. Prices received and paid by farmers apply to the 1949 season and are shown in Appendix Table 1.

These estimates are applicable to owner operators who pay one-fifth of the rice crop for irrigation water. Net returns represent returns for the operator's labor and management and for the use of land. *Although the estimated returns are shown in absolute dollar values the relative differences indicated for the systems under consideration are regarded as most important.* Income in the form of farm perquisites were not included.

Estimated gross farm receipts and also returns to the operator are considerably higher for the two-three and two-four rice-improved pasture systems than for any of the other three systems (Table 14). Excluding price, the major factors affecting income are the yields per acre of rice and production of beef. Although there are fewer acres of rice with these systems than with the "one-one" systems, rice production and sales are considerably larger. This is due to the higher yield per acre of rice (20 and 21 barrels versus 12 and 13 barrels) which can be expected as a result of the longer rotation and the practices applied on pastures. Beef production with the two-three and two-four rice-improved pasture systems

is about 5 and 6 times more for these systems, respectively, compared with the one-one rice-native grass system, and considerably higher than for the one-one rice-lespedeza or the two-three rice-temporary pasture systems. This is due in part to a larger acreage of improved pasture but mainly to increased carrying capacity of the pastures.

TABLE 14.—Estimated Income and Expenses for Selected Rotation Programs on a Medium-sized Rice Farm, 1919 Prices¹

Items	One-one rice- native grass	One-one rice- lepedeza pasture	Two-three rice- temporary pasture	Two-three rice- improved pasture	Two-four rice improved pasture
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Farm receipts:					
Rice ²	13,339	14,451	14,228	17,786	15,523
Beef cattle	1,446	3,024	4,869	7,243	8,752
A. C. payments	0	533	750	750	750
Total	14,785	18,008	19,847	25,779	25,025
Cash expenses on rice:					
Seed	1,240	1,240	992	992	825
Fertilizer	880	880	1,088	480	400
Drying	1,200	1,300	1,280	1,520	1,396
Hired labor	750	750	535	535	445
Fuel and lubricants	540	540	435	435	362
Machinery repairs	547	547	417	417	330
Int. on prod. loan	200	200	160	160	133
Miscellaneous	148	174	149	160	140
Sub-total	5,505	6,111	5,056	4,699	4,031
Cash expenses on beef cattle and pasture:					
Hired labor	15	133	464	618	687
Seeds	0	625	790	1,048	877
Fertilizer	0	862	1,173	1,656	1,842
Fuel and lubricants	0	140	220	213	257
Machinery repairs	0	39	68	91	109
Feeds	231	744	484	594	721
Veterinary, etc.	43	105	175	198	240
Marketing and hauling	89	176	231	408	493
Miscellaneous	44	64	113	138	168
Sub-total	422	2,888	3,718	4,964	5,394
Other cash expenses:					
Bldg., fence repairs	395	425	475	540	600
Taxes and misc.	317	317	317	317	317
Total cash expenses	6,639	9,741	9,566	10,520	10,342
Receipts less cash exp.	8,146	8,267	10,281	15,259	14,683
Int. on investment ³	858	1,093	1,312	1,525	1,706
Depreciation	1,780	1,840	2,077	2,099	2,099
Total non-cash	2,638	2,933	3,389	3,624	3,805
Returns to operator ⁴	5,508	5,334	6,892	11,635	10,878

¹Detailed statement of prices paid and received, farm investments, and depreciation charges shown in Appendix Tables 1 through 6.

²Does not include one-fifth of crop paid for irrigation water.

³Computed at 5 per cent on one-half investment in farm buildings and equipment and on estimated total investment in beef cattle.

⁴Represents returns to the operator for labor, management, and the use of land.

The estimated returns to the operator are essentially the same for the one-one rice-native grass and the one-one rice-lespedeza pasture systems. Thus, even though the yield of rice is increased one barrel per acre and some additional income is received from beef and conservation payments, this is practically all offset by the added expenses associated with lespedeza.

With the one-one rice-native grass system, the income from cattle exceeds expenses by \$1,000. Thus, about one-fifth of the \$5,508 estimated returns to the operator is derived from the cattle enterprise. With the one-one rice-lespedeza system the gross income from beef cattle and from conservation payments exceeds the costs associated with pasture and cattle by less than \$600. In other words, if all the added expenses associated with pasture are charged to the cattle enterprise, the returns so derived would be about \$400 less than those obtained from cattle with the one-one rice-native grass system. However, with lespedeza in the system, rice yields are expected to be about one barrel per acre higher. The value of this added production less water rent, drying, and hauling charges is about \$500 with rice prices at \$7 per barrel. Therefore, it can be said that the contributions of the pasture and cattle program to the combined cash receipts from cattle and rice are about \$100 higher when lespedeza is included in the "one-one" system. However, the non-cash costs are somewhat higher when the cattle numbers are increased, so the net returns to the operator are about \$200 less for the one-one rice-lespedeza pasture system.

The estimated returns from the two-three rice-temporary pasture rotation are about \$800, or some 12 per cent, higher than for either of the "one-one" rotation programs. The increased beef production and the improved rice yields are jointly responsible for the higher estimated returns when this rotation plan is followed.

The estimated returns to the operator are substantially higher when a well-improved pasture-beef cattle enterprise is included in the rotation program. The greater efficiency of the beef cattle enterprise and the complementary effects of pastures upon the rice enterprise are jointly responsible for a greater part of such increase in returns. Also, some of the increase in returns is attributable to the somewhat greater skills and improved management required for the two-three and two-four rice-improved pasture systems, to more hours of labor on the part of the operator, and to the use of more capital in the farm organization. An investment in beef cattle of only about \$5,000 is required for the one-one rice-native grass rotation compared with about \$16,000 and \$19,000, respectively, for the two-three and the two-four rice-improved pasture programs.

For the two rotation programs which include improved pastures, the estimated returns are \$750, or about 7 per cent, higher when the land is kept out of rice for only three years compared with four years. In other words, with rice prices at \$7 per barrel and feeder calves at 19 cents per

pound, the value of the smaller volume of rice produced on 33 per cent compared with 40 per cent of the cropland is not fully covered by the increase in sales of beef from the additional animals which the larger pasture acreage will carry. Rice farmers generally are somewhat more concerned with their rice enterprise compared with their interest in beef production, and the comparative returns from these two programs indicate that under prices prevailing in 1949, they are well justified in holding to this general position. However, with somewhat lower rice prices compared with the 1949 rice-beef cattle price ratio, the estimated returns from these systems would be approximately equal.

Changes in the level of prices affect the incomes received by farmers. Also the relationship of the price received for rice to prices received for beef cattle is of greater importance when both of these enterprises are comparatively well developed in terms of their optimum input-output ratios. These points are illustrated in Table 15, which shows the estimated returns to the operator from the several rotation programs when

TABLE 15.—Estimated Returns to the Operator with Specified Farming Systems and Varying Prices of Rice and Beef Cattle

System	Beef cattle prices per lb. ¹	Rice prices (dollars per barrel)			
		\$7.00	\$5.75	\$4.50	\$3.25 ²
		Estimated net return to operator ³			
	Cents	Dollars	Dollars	Dollars	Dollars
One-one rice- native grass	21	5,956	3,556	1,156	-1,244
	18	5,699	3,299	899	-1,501
	15	5,442	3,042	642	-1,758
	12	5,185	2,785	385	-2,015
One-one rice- lespedeza pasture	21	6,558	3,938	1,338	-1,262
	18	6,018	3,418	818	-1,782
	15	5,498	2,898	298	-2,302
	12	4,978	2,378	- 222	-2,822
Two-three rice- temporary pasture	21	7,868	5,308	2,708	188
	18	7,048	4,488	1,888	- 632
	15	6,228	3,668	1,068	-1,452
	12	5,408	2,848	248	-2,272
Two-three rice- improved pasture	21	12,872	9,672	6,472	3,272
	18	11,679	8,479	5,279	2,079
	15	10,486	7,286	4,086	886
	12	9,293	6,093	2,893	- 307
Two-four rice- improved pasture	21	12,308	9,515	6,722	3,929
	18	10,870	8,077	5,284	2,491
	15	9,432	6,639	3,846	1,053
	12	7,994	5,201	2,408	- 385

¹Applies to total pounds of beef available for market shown in Table 13.

²Applies to total production shown in Table 13 less one-fifth share for water rent. Income from A. C. payments and total cash and non-cash expenses same as shown in Table 14.

³Returns to the operator for his labor, management and land.

the prices of rice and beef cattle vary over a considerable range. The income from agricultural conservation practices and expense items were not changed from that shown in Table 14.

A change of \$1.25 per barrel in rice prices would increase or decrease the estimated returns to the operator from \$2,400 to \$3,200 depending upon the rotation program that is followed. Likewise, a change of 3 cents per pound in beef cattle prices would affect the income about \$250 with the one-one rice-native rotation and \$1,400 with the two-four rice-improved pasture rotation.

The relative profitableness of the systems previously described may be shifted as a result of variations in prices received. For example, with \$5.75 rice and 18 cents or higher cattle prices the one-one rice-lespedeza pasture system is more profitable than the one-one rice-native grass system. But with the same rice prices, \$5.75 per barrel, and 15 cents or lower cattle prices, the position of these two systems is reversed. Likewise if a farmer develops a well-improved pasture-beef cattle enterprise, the relationship between rice and beef cattle prices may determine whether it is profitable to plant only 33 per cent of the cropland in rice each year as compared with 40 per cent. For example, the estimated returns shown in Table 15 indicate that with rice prices at \$5.75 per barrel or higher, it is profitable to follow the two-three rice-improved pasture rotation even with 21-cent beef prices. However, if the price of beef is above 21 cents or rice prices drop to \$4.50 per barrel while beef prices hold as high as 18 cents, the two-four rice-improved pasture rotation, or 33 per cent of the land in rice, would be more profitable. Should the price of beef cattle decline to 15 cents per pound as rice prices drop to \$4.50 per barrel, then it would still be profitable to follow the two-three rice-improved pasture rather than the two-four rice-improved pasture rotation.

APPENDIX

APPENDIX TABLE 1.—Prices Paid for Items Purchased and Received for Products Sold, 1949

Items	Unit	Cost
Prices Paid:		<i>Dollars</i>
Hired labor:		
Wages without board:		
Previous to harvest	Per day	3.50
During harvest	"	6.00
Year-round workers	Per month	90.00
Custom services:		
Seed treatment	Bbl.	.35
Combining	"	.60
Combine and hauling	"	.75
Hauling	"	.15
Drying	"	.50
Storage and insurance	"	.30
Planting seed:		
Rice:		
Zenith	"	8.00
Rexoro	"	12.00
Lespedeza:		
Common	Lb.	.40
Kobe	"	.20
Rye grass	"	.12
Dallis grass	"	.60
White Dutch clover	"	.80
Fuel and lubricants:		
Gasoline:		
Truck and auto	Gal.	.30
Combine, tractor, and other	"	.16
Tractor fuel or distillate	"	.13
Butane	"	.095
Natural gas	1,000 cu. ft.	.35
Oil:		
Truck and auto	Qt.	.40
Combine, tractor, and other	"	.20
Grease:		
Light	Lb.	.15
Heavy	"	.18
Feed, fertilizer and misc.:		
Protein feed (checkers)	Ton	80.00
Rice bran	"	35.00
Cottonseed hulls	"	15.00
Rice straw	"	15.00
Mineral mix ¹	Cwt.	2.00

(Continued)

TABLE 1. (Continued)

Items	Unit	Cost
Fertilizer:		<i>Dollars</i>
4-12-4	Ton	44.00
5-10-5	"	46.00
0-14-7	"	36.00
3-12-12	"	46.00
Am. nitrate (33 per cent)	"	80.00
Am. sulfate (20 per cent)	"	64.00
Baling cord	Roll	15.00
Vaccines, sprays, etc.:		
Anthrax — all mature animals	Head	.25
Blackleg — calves only	"	.25
Bang's — heifer calves 4 to 8 mo.	"	.50
Worm treatment — mature animals	"	.16
— calves	"	.08
Spray materials		.20
Marketing cost	Per \$100	5.00
Overhead cash and non-cash items—		
Taxes	Per acre	.07 ³
Interest:		
On production credit	Per \$100	6.00 ⁴
Farm machinery ($\frac{1}{2}$ of original cost)		5.00
Beef cattle herd	"	5.00
Prices Received:		
Rice: ⁵		
Zenith	Bbl.	6.00
Rexoro	"	7.75
Calves:		
Under 350 lbs.	Lbs.	.18
350 to 425 lbs.	"	.185
425 lbs. and over	"	.19
Cows and bulls:		
Under 800	"	.15
Over 800	"	.16

¹Mixed on farm; one part oyster shell flour, one part steamed bone meal, and two parts salt.

²One roll ties about 500 bales.

³Equal to 40 mills on average assessed value of \$23 per acre less \$2,000 homestead exemption.

⁴Average loan estimated at \$33 per acre for period of 6 months.

⁵A price of \$7.00 per barrel is referred to in the text and is a weighted average of the 1949 prices for medium and long grain varieties. Zenith and Rexoro are examples of these respective grain types.

APPENDIX TABLE 2.—Estimated Quantities and Costs of Labor, Power, and Materials Required for Establishing and Maintaining Pastures

Items	Units	Requirements per acre	
		Quantity	Costs
Establishing:		<i>Dollars</i>	
Rye grass:			
Labor	Hours	2.0	.80
Tractor work	Hours	1.8	1.05
Fertilizer ¹	Cwt.	3.0	6.90
Seed	Pounds	25.0	3.00
Total	.....	....	11.75
Lespedeza (Kobe):			
Labor	Hours	1.7	.68
Tractor work	Hours	1.5	.88
Fertilizer	Cwt.	3.0	6.90
Seed	Pounds	25.0	5.00
Total	.....	....	13.46
Improved mixture:			
Labor	Hours	2.7	1.08
Tractor work	Hours	2.5	1.48
Fertilizer	Cwt.	3.0	6.90
Seed:			
White Dutch clover	Pounds	5.0	4.00
Dallis grass	Pounds	12.0	7.20
Total	.....	....	20.66
Annual maintenance:			
Lespedeza:			
Labor ²	Hours	.8	.32
Tractor work	Hours	.6	.35
Fertilizer	Cwt.	3.0	6.90
Seed ³	Pounds	10.0	2.00
Total	.....	....	9.57
Improved mixtures:			
Labor ²	Hours	1.2	.48
Tractor work	Hours	1.0	.59
Fertilizer	Cwt.	3.0	6.90
Total	.....	....	7.97

¹Complete fertilizer of 3-12-12 analysis used in all cases.

²Assumes lespedeza mowed one time and improved pasture twice, plus labor and tractor work required for applying fertilizer.

³Overseed to replenish stand.

APPENDIX TABLE 3.—Farm Improvements Inventory and Annual Depreciation for a Medium-sized Rice Farm with Variations Required for Selected Rice-Pasture Rotations

Farm improvements	Expected life	Estimated value ¹	Annual depreciation
	<i>Years</i>	<i>Dollars</i>	<i>Dollars</i>
Common to all rotations:			
Operator's dwelling	25	5,600	224
Tenant house	25	1,400	56
Garage	20	200	10
Machine shed	20	400	20
Poultry house	20	160	8
Miscellaneous	---	350	18
Sub-total	---	8,110	336
Variable for selected rotations:			
One-one rice-native grass:			
Stock barn	20	800	40
Feed & grain storage	20	200	10
Fences	12	1,175	94
Feed racks, etc.	7	100	15
Total ²		10,385	495
Estimated annual repairs			395
One-one rice-lesp. pasture:			
Stock barn	20	1,000	50
Feed & grain storage	20	400	20
Fences	12	1,175	94
Feed racks, etc.	7	200	30
Total ²		10,885	530
Estimated annual repairs			400
Two-three & two-four rice-imp. pasture:			
Stock barn	20	1,400	56
Feed & grain storage	20	600	30
Fences	12	1,292	103
Feed racks, etc.	7	300	45
Total ²		11,702	570
Estimated annual repairs			425
Two-three & two-four rice-imp. pasture:			
Stock barn	20	1,600	80
Feed and grain storage	20	800	40
Fences	12	1,528	122
Feed racks, etc.	7	400	60
Total ²		12,438	638
Estimated annual repairs			600

¹Estimated replacement value as of 1949 price level.

²Totals include the sub-total shown above for the improvements common to all rotations plus the items shown for each of the rotations under consideration.

APPENDIX TABLE 4.—Rice Equipment Inventory for a Medium-sized Farm with Expected Life and Annual Depreciation¹

Items	Expected life	No.	Original cost	Annual depreciation
	<i>Years</i>		<i>Dollars</i>	<i>Dollars</i>
Power and transportation:				
Tractors	12	2	3,470	289
Truck	10	1	1,600	160
Pickup	10	1	1,100	110
Land prep., levee, and seeding:				
Breaking plows	15	2	640	43
Disk harrow	14	2	450	32
Section harrow	11	2	120	11
Grader	14	1	175	12
Roller or cultipacker	12	1	185	15
Drill	12	1	375	31
Harvesting:				
Combine	10	1	5,170	517
Grain cart	15	1	600	40
Total			13,885	1,260

¹This equipment assumed for all rotation programs. Tractors, trucks, and land preparation equipment used for general farm purposes and in pasture work where needed.

APPENDIX TABLE 5.—Equipment Required for Beef Cattle and Pastures on Medium-sized Farm with Selected Rotation Programs

Items	One-one rice- native grass		One-one rice- leesp. pasture	
	Original cost	Annual depreciation	Original cost	Annual depreciation
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Spray equipment	50	5	200	20
Riding horse	—	—	75	10
Miscellaneous	200	20	200	20
Total	250	25	475	50

Items	Two-three rice- temp. pasture		Two-four rice- improved pasture ¹	
	Original cost	Annual depreciation	Original cost	Annual depreciation
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Spray equipment	200	20	300	30
Fert. distributor	100	10	100	10
Seed dropper	—	—	250	25
Mower	350	35	350	35
Side-del. rake	250	20	250	20
Pickup baler	1,400	117	1,400	117
Riding horses	150	20	150	20
Miscellaneous	250	25	300	30
Total	2,700	247	3,100	287

¹These items of equipment also assumed for the two-three rice-improved pasture rotation.

APPENDIX TABLE 6.—Summary of Investment in Improvements, Equipment, and Livestock on Medium-sized Farm with Selected Rotation Programs

Items	One-one rice- native grass	One-one rice- lespedeza pasture	Two-three rice- temporary pasture	Two-three rice- improved pasture	Two-four rice- improved pasture
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Farm improvements	10,385	10,885	11,702	12,438	12,438
Farming equipment:					
Rice	13,885	13,885	13,885	13,885	13,885
Other: ¹	250	475	2,700	3,100	3,100
Beef cattle	5,325	9,264	12,100	15,780	19,400
Total	29,845	34,509	40,387	45,203	48,823

¹Includes miscellaneous tools for fence building, spray equipment, and pasture seeding and hay making equipment. Note: Value of land not included.

APPENDIX TABLE 7.—Summary of Acres Irrigated and Average Cost of Electricity Per Acre for Operating Electric-powered Rice Wells during the 1951-53 Seasons¹

Well No.	Size of well	Size of motor	1951 season				1952 season				1953 season				1951-53 average	
			Area		Cost of energy		Area		Cost of energy		Area		Cost of energy		Area watered	Cost of energy Total ² Per A.
			In.	H.P.	Acres	Dol.	Per A.	Acres	Dol.	Per A.	Acres	Dol.	Per A.	Acres	Dol.	Dol.
1	8	40	150	968	6.45	150	4.80	155	894	7.45	4.81	4.81	4.81	455	2433	5.35
2	10	40	160	918	5.74	70	372	5.31	140	1018	8.48	6.31	6.31	370	2138	5.78
3	8	40	130	638	4.91	133	618	4.65	130	661	551	4.23	4.23	393	1897	4.60
4	8	45	150	657	4.38	150	726	4.84	85	605	504	5.93	5.93	385	1887	4.90
Sub-total or average			590	3181	5.39	503	2436	4.84	510	3178	2648	5.19	5.19	1603	8265	5.16
5	8	50	170	1183	6.96	178	1127	6.33	167	1012	843	5.05	5.05	515	3153	6.12
6	10	50	160	1113	6.96	160	597	3.73	190	1227	1022	5.38	5.38	510	2732	5.36
7	10	50	160	1153	7.21	160	934	5.84	160	1177	981	6.13	6.13	480	3068	6.39
8	8	50	150	1300	8.67	165	1006	6.10	115	1100	917	7.97	7.97	430	3223	7.50
9	10	50	150	860	5.73	150	690	4.60	150	961	801	5.34	5.34	450	2351	5.22
10	10	50	160	1100	6.88	190	1440	7.58	200	1480	1233	6.17	6.17	550	3773	6.86
Sub-total or average			950	6709	7.06	1063	5794	5.78	982	6957	5797	5.90	5.90	2935	18300	6.24
11	10	60	160	1116	6.98	140	1104	7.88	160	1390	1158	7.24	7.24	460	3378	7.13
12	10	60	175	1152	6.58	175	996	5.69	175	1224	1020	5.82	5.82	525	3168	6.03
13	10	60	160	1147	7.17	160	1270	7.94	230	1457	1214	5.27	5.27	550	3631	6.60
14	10	60	236	1650	6.99	225	1459	6.48	225	1245	1037	4.68	4.68	684	4146	6.06
15	10	60	150	1371	9.14	150	1186	7.91	213	1506	1255	5.89	5.89	513	3812	7.43
Sub-total or average			881	6436	7.31	850	6015	7.08	1001	6822	5684	5.68	5.68	2732	18135	6.64
16	12	75	150	843	5.62	150	770	5.13	150	737	614	4.09	4.09	450	2227	4.95
17	10	75	250	1176	5.11	250	1221	4.88	250	1242	1035	4.97	4.97	750	3432	4.58
18	10	75	340	1957	5.76	230	991	4.31	290	1484	1237	4.27	4.27	860	4185	4.87
19	8	75	175	1902	10.87	165	1509	9.15	110	1200	1000	9.08	9.08	450	4411	9.80
20	10	75	115	490	4.26	165	646	3.92	150	1435	1196	7.97	7.97	430	2332	5.42
21	10	100	340	1820	5.35	210	1180	5.62	210	2163	1802	8.58	8.58	760	4802	6.32
Sub-total or average			1370	8188	5.98	1170	6317	5.40	1160	8261	6884	5.93	5.93	3700	21389	5.78
Total or average			3791	24514	6.47	526	20562	5.83	3653	25218	21013	5.75	5.75	10970	66089	6.07

¹Only includes cost of electricity; no repairs or overhead costs included.

²The major company servicing the rice area increased their rates 20 per cent in Jan. 1953. Thus it was necessary to adjust the 1953 cost downward to make comparable with other cost data included in this study and which reflect 1949 prices.

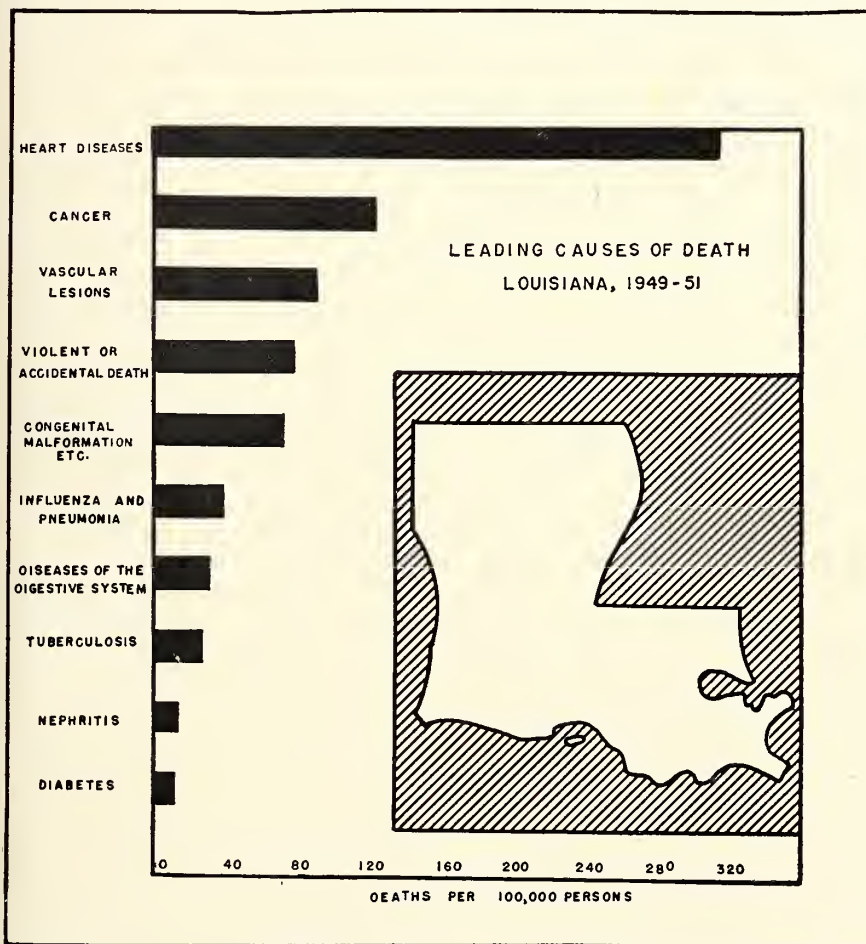
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HEALTH

in RURAL LOUISIANA at MID-CENTURY

by

Homer L. Hitt and Paul H. Price



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Health in Rural Louisiana at Mid-Century

by

HOMER L. HITT AND PAUL H. PRICE

The health of Louisiana's rural people has been of primary interest in the research program of the Department of Rural Sociology for more than a decade. During this time, investigations have been concerned with mortality experience, causes of death, variations in fertility, hospital facilities, levels of living, distribution of medical personnel, attitudes toward dental care, as well as with other basic aspects of rural health. Several individual research reports have been published on these specific subjects.¹ This study attempts to set forth in a single bulletin the more significant features of the present health situation of rural Louisianians. As such, it draws upon the previous research of the Department of Rural Sociology and also presents recent and yet unpublished findings resulting from the continuous efforts of the Department in rural health research.

THE NEED FOR HEALTH AND MORTALITY STUDIES

Knowledge is the most effective weapon at man's disposal in his incessant struggle to control disease and prolong life. Only insofar as his understanding of the conditions of human existence is increased does man find it possible to strengthen his position in this age-old battle. Among the more important types of information bearing upon society's effort to improve health are periodic accountings of the rate at which a population is dying and of the causes of death. It follows that a comprehensive study of health and mortality in Louisiana at mid-century will allow for an evaluation of the progress which has been made in health matters and will point up areas in which additional effort needs to be expended.

¹Louise Kemp and T. Lynn Smith, *Health and Mortality in Louisiana*, Louisiana Agricultural Experiment Station Bulletin 390, Baton Rouge, May 1945. J. Allan Beegle and T. Lynn Smith, *Differential Fertility in Louisiana*, Louisiana Agricultural Experiment Station Bulletin 403, Baton Rouge, June 1946. Homer L. Hitt and Alvin L. Bertrand, *Social Aspects of Hospital Planning in Louisiana*, Louisiana Study Series No. 1, August 1947. Alvin L. Bertrand and Homer L. Hitt, *Parental Attitudes and Dental Care for Children*, Louisiana Agricultural Experiment Station, published in cooperation with the State Health Department, October 1948. Paul H. Price and Homer L. Hitt, *The Availability of Medical Personnel in Rural Louisiana*, Louisiana Agricultural Experiment Station Bulletin 459, Baton Rouge, June 1951. Paul H. Price, *Modifying Dental Attitudes Through Community Programs*, Louisiana Agricultural Experiment Station, published in cooperation with the State Health Department, May 1952.

It may be confidently assumed that an area with a high death rate is also characterized by a high incidence of disease. Consequently, mortality data provide valuable information concerning prevalence of disease and general health. This is especially important because the data regarding morbidity are very poor and of little use to the researcher. The most fruitful approach to the study of the general health of a population is in analyzing conditions of mortality which characterize it. A high incidence of mortality prevails when inadequate control is exercised over conditions giving rise to the spread or prevalence of disease. It may result from one or more such factors as a low level of understanding in regard to disease causation, a lack of medical personnel and facilities, inadequate preventive medicine, poor public health sanitation, and a generally low level of living.

There are only three factors which affect the number and distribution of a population: migration, births, and deaths. In order to anticipate and understand the pattern of growth of a population, detailed knowledge of all of these phenomena is required. The role of deaths in population change is clarified by mortality studies.

If the available resources in the state are to be most effectively utilized, a comprehensive knowledge of health and mortality conditions is essential. Hospital planning; public health programs; physician, dentist, and nurse training; educational programs; and similar undertakings all require a thorough understanding of mortality rates and causes of death.

The direction and emphasis of the various research programs in the field of health which are conducted in medicine, the physical sciences, the social sciences, etc., depend to a large part upon knowledge of the health and mortality situation prevailing at the time. Thus, at present, much emphasis is being placed upon heart disease and cancer research because mortality studies have revealed them to be major obstacles to the further advancement of the general health of the population.

Also, health and mortality studies are of fundamental importance as indicators of social and cultural conditions existing in an area. For example, a high death rate almost always reflects a low level of living. To the extent that mortality and disease are socially and culturally determined, analyses of the causes of death and the magnitude of mortality rates can provide much insight into the social and cultural pattern of an area.

METHODOLOGY

This analysis is concerned with the status of mortality and other related health indexes for the state of Louisiana. An attempt is made to clarify and point up variations in mortality between rural and urban peoples, males and females, and whites and nonwhites. These differences are considered on the parish level as well as for the state as a whole.²

² In Louisiana, parishes are the political subdivisions which correspond to counties in other states.

Furthermore, an effort is made to show the effect that the age composition of the various populations has upon their mortality experience.

In order to condense and simplify the presentation of mortality patterns in 64 parishes by sex, race, and residence, graphics are used extensively instead of the more cumbersome textual or tabular procedures. The more significant facts apparent to the writers are spelled out in each phase of the analysis; however, the details are left for the reader to glean from the maps themselves. For the use of persons who have need of specific figures and rates, the basic tables from which the maps have been prepared are included in the Appendix. Reference to these appendix tables is made throughout the manuscript. In this manner, the authors believe that the most complete and detailed presentation of the conditions of mortality existing in Louisiana at Mid-Twentieth Century which has yet been published is made available to interested persons.

Several different techniques of measurement are utilized in this study which require explanation. The most fundamental index of mortality used is the *crude death rate*. This measurement is obtained by dividing the number of deaths occurring in any one year by the total population and multiplying this figure by 1,000.

$$(\text{Crude death rate} = \frac{\text{Number of deaths in one year}}{\text{Population}} \times 1,000)$$

The crude death rate, therefore, represents the number of persons dying in one year per 1,000 persons in the population.

Another basic measurement used in this analysis of mortality is the *specific cause death rate*. It is simply a ratio of the number of persons dying from a specific disease (e.g., cancer) during a particular year to the total population.

$$\left. \begin{array}{l} \text{(Specific} \\ \text{cause} \\ \text{death rate)} \end{array} \right\} = \frac{\text{Number of deaths due to a specific cause in one year}}{\text{Population}} \times 100,000)$$

This rate is usually expressed in terms of 100,000 population. Therefore, a rate of 275 means that this number of persons died from a certain disease per 100,000 people. In the part of this study which considers causes of death by parishes, the specific cause rate is expressed in terms of 10,000 persons. This is feasible because of the relatively small number of persons residing in a great majority of the parishes of Louisiana.

The *infant mortality rate* is another significant index of mortality relied upon in this analysis. This rate expresses the number of babies dying in one year for each 1,000 live births.

$$\left. \begin{array}{l} \text{(Infant} \\ \text{mortality} \\ \text{rate)} \end{array} \right\} = \frac{\text{Number of children under one year of age dying in one year}}{\text{Number of live births in same year}} \times 1,000)$$

The great importance generally attributed to this rate as a gauge of the well-being of a society and of its public health practices makes this a fundamental tool in health studies.

Age and mortality are closely related. In order to make valid comparisons of the mortality level in various populations, it is necessary to eliminate or take account of the influence of their respective age structures. The device employed for this purpose is the *standardized death rate*. This rate corrects for variations in mortality resulting from differences in age structure of the groups. Thus, comparisons of standardized death rates for parishes can be made without the operation of the complicating factor of age differentials. It follows that variations in mortality among populations revealed by standardized death rates must be explained on the basis of factors other than differences in age.

Two recognized methods are available for standardizing death rates for age. These are generally called the direct and the indirect methods. In this study, the indirect method has been utilized exclusively because of the nature of the data for parishes. In simple terms, the indirect method of standardization for age means that a standard population is selected and the age specific death rates of the standard are applied to the population being analyzed. Thus, a death rate is calculated by this method which shows what the death rate of a population would have been had the same age specific death rates of the standard population prevailed. Based on this index, the crude death rate is accordingly adjusted to compensate for the advantage or disadvantage shown to be due to differential age structure. In this analysis, the population of the United States in 1940 is used as the standard. Since the details of calculation of standardized death rates by the indirect method are many and complicated, no attempt is made to present a description of the procedure. Instead, the reader is referred to a work entitled *Principles of Medical Statistics* by Bradford Hill which provides an adequate description of the details of calculation.³

In studying the mortality experience of parish populations, the researcher is often faced with the necessity of dealing with relatively small numbers of cases. Under this circumstance, if data for a single year are utilized, the possibility of an unusual situation greatly distorting the picture must be recognized. In order to eliminate this possibility to as large an extent as is possible, the rates are based on three-year averages of deaths in all analyses made at the parish level and for other areas when such a procedure is possible and feasible. The period 1949-1951 is used in most cases, and the averages for this period are related to the population of 1950 as enumerated by the Census. Most of the data on mortality are obtained from releases of the Division of Public Health Statistics of the Louisiana State Department of Health. In analyses in which *Vital Sta-*

³ Bradford Hill, *Principles of Medical Statistics*, New York: Oxford University Press, 1950, Fifth Edition, Chapter XVIII.

tistics of the United States are utilized, the period 1946-1948 has been employed because these are the most recent years for which comparable data required for computing three-year averages of causes of death have been made available. The volume *Vital Statistics* for 1949 has been published, but its reliance upon a revision of the International List of Causes of Death precludes the computation of three-year averages for 1947-1949.

The final index of mortality employed in this analysis is the *life table*. This measurement shows the average number of years of life that can be expected by a member of a specific population at any given age. For this investigation, Louisiana life tables differentiated according to sex, race, and residence have been computed for 1940-41. These years are used because mortality and other data needed to calculate life tables for the sex, race, and residence groups of the state are not available for 1950. Life tables in this study have been prepared according to the method outlined by Lowell T. Reed and Margaret Merrill.⁴ Since the details of construction are elaborate and involved, no attempt will be made to explain the procedure. The interested reader is referred to the aforementioned article by Reed and Merrill.

It will be noted that all of these indexes of mortality utilize death registration data. The system of death registration which has been developed in the United States is operating at a level of efficiency to assure relatively complete and accurate basic mortality data for analysis. As a result, health or mortality phenomena observed from the study of these data are, for the most part, real and not the result of a faulty system of recording deaths. This means that confidence can be placed in the mortality data and in the findings of researchers relative to general health based on these materials.

THE RURAL POPULATION, 1950

The 1950 Census reported 1,211,820 persons as residents of the rural areas of the state. These rural dwellers, who comprised 45.6 per cent of the state's 2,683,516 people, are not evenly distributed throughout Louisiana. (See Table I.) In fact, in 1950, seventeen parishes were totally rural while one parish was completely urban. The totally rural parishes were Assumption, Bienville, Caldwell, Cameron, Catahoula, Grant, La Salle, Livingston, Plaquemines, Red River, Sabine, St. Helena, St. James, Tensas, Union, West Carroll, and West Feliciana.⁵ The totally urban parish, of course, is Orleans. In all but nine parishes (Orleans, Caddo, Calcasieu, East Baton Rouge, Iberia, Lafayette, Ouachita, Jefferson, and St. Mary Parishes) the rural people were in the majority. Outside of

⁴ Lowell T. Reed and Margaret Merrill, "A Short Method for Constructing an Abridged Life Table," *Vital Statistics—Special Reports*, Vol. 9, pp. 681-712.

⁵ According to the old census definition of urban, 20 parishes were totally rural in 1950. St. Bernard, St. Charles, and St. John the Baptist were included as totally rural in addition to the above-listed parishes.

New Orleans, Baton Rouge, Shreveport, Lake Charles, Lafayette, and a few other lesser cities, the rural way of life based primarily on agricultural pursuits still dominates the scene in Louisiana. Unquestionably, the rural population continues to be of great significance for the state socially and economically as well as numerically. It follows that the health status of rural Louisianians is a matter of genuine importance.

It should be recognized that recent decades have witnessed the declining relative numerical importance of rural people in the state's pop-

TABLE I. — Population of the Parishes of Louisiana, 1950, by Residence*

Parish	Total Population	Urban		Rural	
		Number	Per Cent	Number	Per Cent
Acadia	47,050	22,166	47.1	24,884	52.9
Allen	18,835	5,598	29.7	13,237	70.3
Ascension	22,387	4,150	18.5	18,237	81.5
Assumption	17,278			17,278	100.0
Avoyelles	38,031	8,301	21.8	29,730	78.2
Beauregard	17,766	5,799	32.6	11,967	67.4
Bienville	19,105			19,105	100.0
Bossier	40,139	16,779	41.8	23,360	58.2
(Old definition)		(15,470)	(38.5)	(24,669)	(61.5)
Caddo	176,547	133,429	75.6	43,118	24.4
(Old definition)		(127,206)	(72.1)	(49,341)	(27.9)
Calcasieu	89,635	64,691	72.2	24,944	27.8
(Old definition)		(53,702)	(59.9)	(35,933)	(40.1)
Caldwell	10,293			10,293	100.0
Cameron	6,244			6,244	100.0
Catahoula	11,834			11,834	100.0
Claiborne	25,063	7,789	31.1	17,274	68.9
Concordia	14,398	3,847	26.7	10,551	73.3
De Soto	24,398	4,440	18.2	19,958	81.8
East Baton Rouge	158,236	135,767	85.8	22,469	14.2
(Old definition)		(125,629)	(79.4)	(32,607)	(20.6)
East Carroll	16,302	4,123	25.3	12,179	74.7
East Feliciana	19,133	6,772	35.4	12,361	64.6
Evangeline	31,629	6,633	21.0	24,996	79.0
Franklin	29,376	3,655	12.4	25,721	87.6
Grant	14,263			14,263	100.0
Iberia	40,059	21,159	52.8	18,900	47.2
Iberville	26,750	5,747	21.5	21,003	78.5
Jackson	15,434	3,097	20.1	12,337	79.9

(Continued)

TABLE I. — Population of the Parishes of Louisiana, 1950, by Residence*

(Continued)

Parish	Total Population	Urban		Rural	
		Number	Per Cent	Number	Per Cent
Jefferson	103,873	92,215	88.8	11,658	11.2
(Old definition)		(31,070)	(29.9)	(72,803)	(70.1)
Jefferson Davis	26,298	12,512	47.6	13,786	52.4
Lafayette	57,743	33,541	58.1	24,202	41.9
LaFourche	42,209	10,550	25.0	31,659	75.0
(Old definition)		(7,730)	(18.3)	(34,479)	(81.7)
La Salle	12,717			12,717	100.0
Lincoln	25,782	10,372	40.2	15,410	59.8
Livingston	20,054			20,054	100.0
Madison	17,451	7,758	44.5	9,693	55.5
Morehouse	32,038	12,769	39.9	19,269	60.1
Natchitoches	38,144	9,914	26.0	28,230	74.0
Orleans	570,445	570,445	100.0		
Ouachita	74,713	48,874	65.4	25,839	34.6
Plaquemines	14,239			14,239	100.0
Pointe Coupee	21,841	2,818	12.8	19,023	87.1
Rapides	90,648	41,336	45.6	49,312	54.4
Red River	12,113			12,113	100.0
Richland	26,672	3,138	11.8	23,534	88.2
Sabine	20,880			20,880	100.0
St. Bernard	11,087	2,643	23.8	8,444	76.2
(Old definition)		()	()	(11,087)	(100.0)
St. Charles	13,363	3,366	25.2	9,997	74.8
(Old definition)		()	()	(13,363)	(100.0)
St. Helena	9,013			9,013	100.0
St. James	15,334			15,334	100.0
St. John	14,861	4,465	30.0	10,396	70.0
(Old definition)		()	()	(14,861)	(100.0)
St. Landry	78,476	10,843	25.3	58,633	74.7
St. Martin	26,353	4,614	17.5	21,739	82.5
St. Mary	35,848	18,522	51.7	17,326	48.3
St. Tammany	26,988	8,577	31.8	18,411	68.2
Tangipahoa	53,218	14,904	28.0	38,314	72.0
Tensas	13,209			13,209	100.0
Terrebonne	43,328	16,314	37.7	27,014	62.3
(Old definition)		(11,505)	(26.6)	(31,823)	(73.4)

(Continued)

TABLE I. — Population of the Parishes of Louisiana, 1950, by Residence*
(Continued)

Parish	Total Population	Urban		Rural	
		Number	Per Cent	Number	Per Cent
Union	19,141			19,141	100.0
Vermilion	36,929	13,900	37.6	23,029	62.4
Vernon	18,974	4,670	24.7	14,304	75.3
Washington	38,371	17,798	46.4	20,573	53.6
Webster	35,704	13,170	36.9	22,534	63.1
West Baton Rouge	11,738	3,097	26.4	8,641	73.6
West Carroll	17,248			17,248	100.0
West Feliciana	10,169			10,169	100.0
Winn	16,119	5,629	34.9	10,490	65.1
LOUISIANA	2,683,516	1,471,696	54.4	1,211,820	45.6
(Old definition)		(1,363,789)	(50.8)	(1,319,727)	(49.2)

Source: U. S. Bureau of the Census. *U. S. Census of Population: 1950, Vol. 1, "Number of Inhabitants,"* Chapter 18: Louisiana. U. S. Government Printing Office, Washington, D. C., 1951.

* Rural and urban are defined according to the new instructions in the 1950 Census. (Figures according to the old census definition are shown in parentheses. Only 10 parishes are affected by the change in definition.)

ulation. In the last century, two rapid periods of urbanization have occurred. The first of these extended from 1820 to 1840, and the second began around 1900 and is still in progress. The rate of urbanization during the last decade has been vastly more rapid than that of the first four decades of this century. In 1950, for the first time in the history of the state, urban people outnumbered those living in rural areas.

THE MORTALITY EXPERIENCE OF LOUISIANA'S RURAL PEOPLE, 1949-1951

Undoubtedly one of the best indexes of the health status of a people is the rate at which deaths occur among them. A society characterized by a high death rate certainly cannot have a health situation comparable to one in which a low rate prevails. This section is devoted primarily to an analysis of the mortality experiences of the state's rural population. The status of rural mortality is pointed up and highlighted by comparison with the mortality of Louisiana's total and urban populations. The relationship of the factors of race, sex, and age to the observed mortality rates is explored insofar as is possible. Throughout this phase of the analysis, variations among parishes in mortality are emphasized. (Appendix Table I.) Such a detailed study of mortality has not been previously made for Louisiana.

During 1949-1951, the people of the state died at a rate of 9.1 per 1,000 population. However, there was considerable variation in crude death rates among the several parishes. Figure 1 graphically depicts these variations. The parishes with the highest crude death rates for the total populations are concentrated wholly along the Mississippi River from the Arkansas boundary to the parish of St. Charles. The four parishes

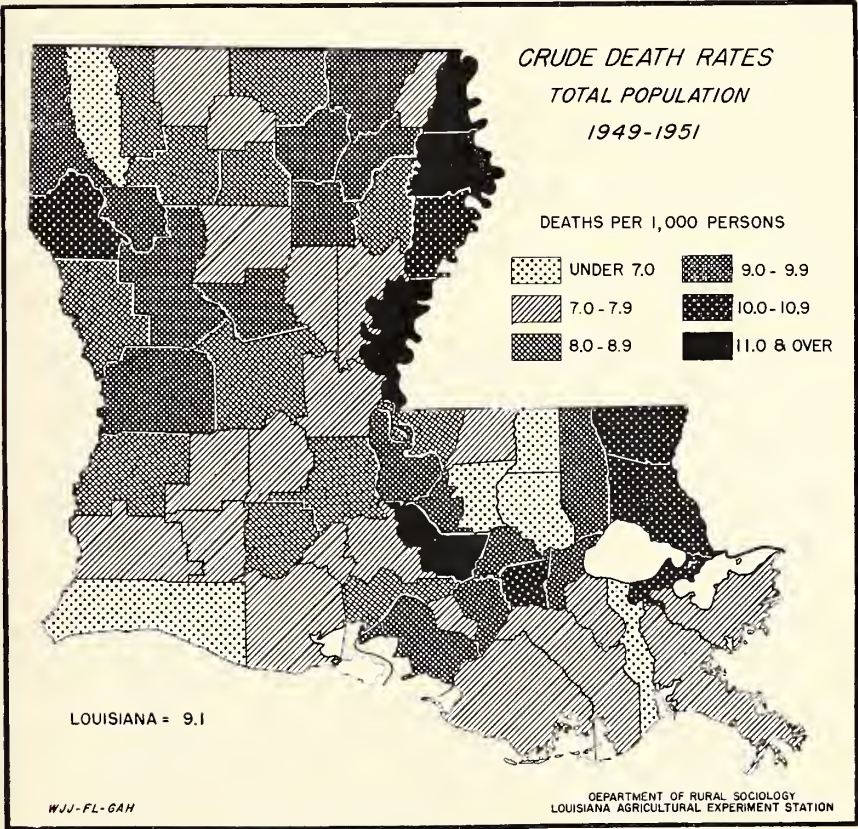


FIGURE 1. Crude Death Rates, Louisiana, 1949-1951, by Parish.

with crude death rates of 11 per 1,000 and over (East Carroll, Madison, Concordia, and Iberville) are all located adjacent to the Mississippi River. Tensas, St. James, and Orleans parishes, which are also located in this elongated area, have relatively high crude death rates. Only Washington, St. Tammany, and De Soto parishes, outside of the river basin, had crude death rates which were relatively high.

Six parishes recorded crude death rates of under 7 per 1,000 population during 1949-1951. These were St. Helena, Livingston, Cameron, Bossier, East Baton Rouge, and Jefferson parishes. Three of them are totally rural, two others are adjacent to parishes with large urban popu-

lations, and one is itself highly urban and experiencing rapid industrial development. Relatively low rates are generally found in the parishes of Southwest Louisiana, the sugar-producing area, central and north-central Louisiana, and the western portion of the Florida Parishes.

The rural population of the state had a significantly lower crude death rate during 1949-1951 than the total population. During that period, rural people died at a rate of 7.9 persons per 1,000 population. Variations in mortality among the rural populations in the several parishes follow a pattern similar to that for the total population. (See Figure 2.) The main exception is that in the majority of the parishes, the mortality of the rural population of the parish is slightly lower than that of the total population. In only nine parishes did the rural people have a higher crude death rate than that of the total population (Bossier, Claiborne, East Baton Rouge, East Feliciana, Jefferson, Morehouse, Pointe Coupee, St. Mary, and West Baton Rouge). The rural residents of only two parishes exhibited crude death rates of 11 or above. These

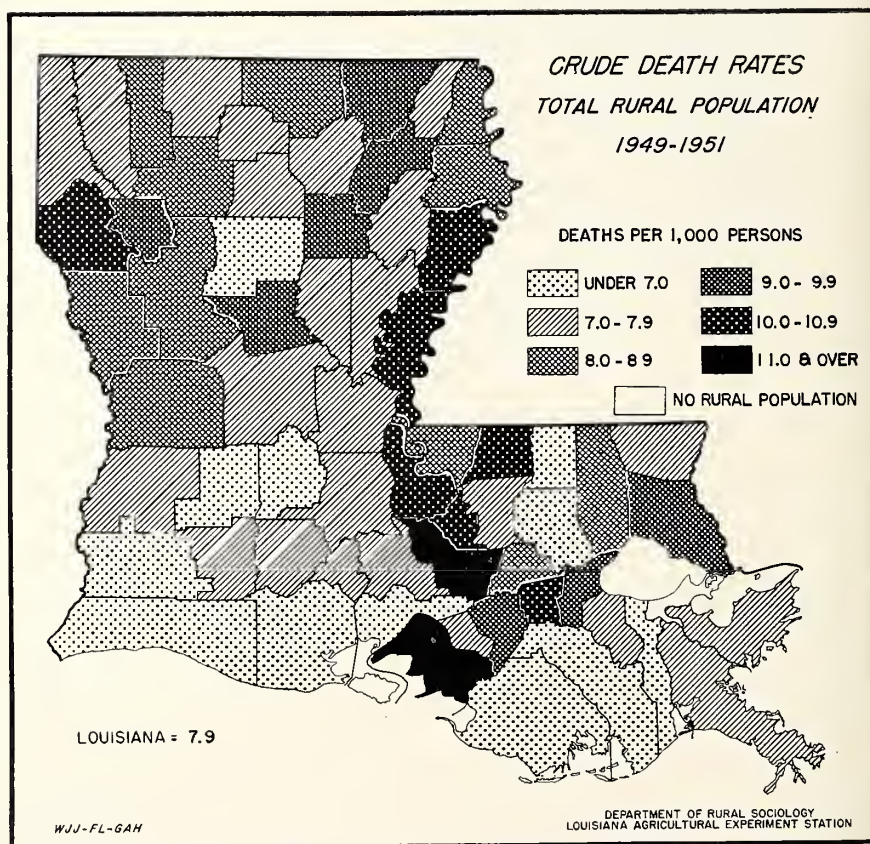


FIGURE 2. Crude Death Rates, Rural Louisiana, 1949-1951, by Parish.

were Iberville and St. Mary. Generally, higher rates for rural people are found in the parishes bordering the Mississippi River. Low crude death rates among rural people are found generally in the parishes of Southwest Louisiana, of the sugar-producing area, in St. Helena and Livingston in the West Florida Parishes, and in Winn Parish in central Louisiana.

The rural population of the state is characterized by a much lower mortality experience than the urban population. In 1949-51, the crude death rate for the urban people of the state was 10.3 per 1,000 population. A comparison of Figure 2 and Figure 3 clearly demonstrates the higher mortality of urban people in relation to the rural population. Whereas the rural residents of only two parishes had crude death rates of 11 and above, the urban dwellers of 16 parishes had rates of such magnitude. These high rates among urban people were found in the parishes bordering the Mississippi River and in Jackson, De Soto, Richland, Franklin, Vernon, Beauregard, Evangeline, Terrebonne, and St.

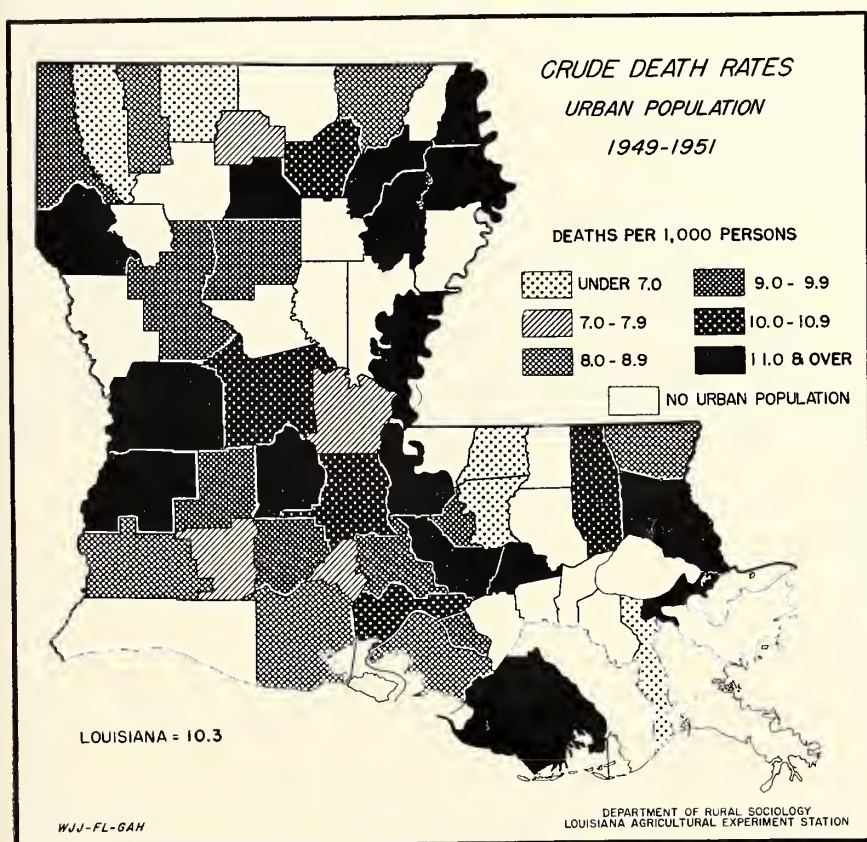


FIGURE 3. Crude Death Rates, Urban Louisiana, 1949-1951, by Parish.

Tammany parishes outside of this area. Low crude death rates among urbanites were found to exist in five parishes, namely Jefferson, East Baton Rouge, East Feliciana, Claiborne, and Bossier. It is of interest to note that the three parishes with the largest cities (Orleans, Caddo, and East Baton Rouge) exhibited widely divergent crude death rates. Orleans had a very high, Caddo had an intermediate, and East Baton Rouge had a low crude death rate. This indicates that factors other than urban residence alone operate to determine the level of mortality of people who live in these metropolitan centers.

In general, the crude death rates of the rural populations were consistently lower than those of the urban people residing in the same parish. In fact, only eight parishes (East Baton Rouge, East Feliciana, West Baton Rouge, Bossier, Claiborne, Jefferson, Morehouse, and St. Mary) deviated from this pattern.

In attempting to explain the relationships which exist between bio-social phenomena and the variations in mortality which have been observed, the racial, sex, and age compositions of the populations being considered must be given prime importance. In the above paragraphs, the mortality experience of rural people has been compared to those of the total and the urban populations. Furthermore, variations among parishes within the rural population itself have been identified and comparisons made within parishes among the rural and urban segments. Some of the differences which have been observed can be explained in part by the fact of rural or urban residence. However, many other factors necessarily must be reckoned with. For instance, residence does not explain the wide variations in mortality noted among the rural populations of the parishes. Such variations must be attributed to factors other than residence. Consequently, in an attempt to explain and clarify the variations in mortality already identified, the relationships which exist between mortality and race, mortality and sex, and mortality and age are analyzed in the following sections.

Mortality and Racial Composition

A factor of great importance in explaining the variations in mortality among the different parishes is the proportion of nonwhites in the population. This obtains because nonwhites have a considerably higher mortality than whites. Consequently, a parish with a few nonwhite residents is not likely to have as high a crude death rate as one with a high proportion of its people in that racial category. The crude death rate in 1949-1951 for nonwhites was 11.5 per 1,000 persons as compared to only 7.9 per 1,000 for whites. In order to reveal the racial differences in mortality which prevail throughout the state, Figures 4 and 5 have been prepared to show crude death rates for nonwhites and whites, respectively. A comparison of these two figures clearly shows the lower mortality characterizing whites. In fact, whites had lower crude death rates than

nonwhites in each of the 64 parishes. Furthermore, these figures demonstrate that in many parishes high crude death rates among nonwhites coexist with low rates among whites.

An examination of the variations in the mortality of the total non-white population (Figure 4) shows that the parishes bordering on or in close proximity to the Mississippi River have high crude death rates.

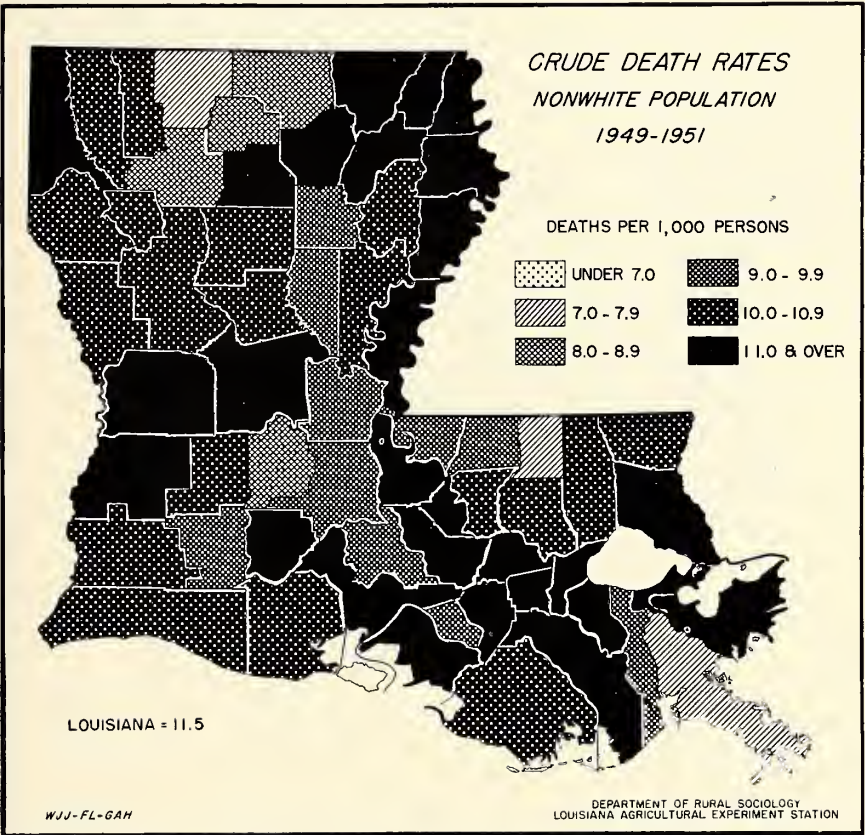


FIGURE 4. Crude Death Rates, Nonwhite Population, Louisiana, 1949-1951, by Parish.

This observation obtains for most of the groups which have been previously examined. However, in the case of the nonwhites, many parishes outside of the Mississippi River area also have high rates. In only three parishes (Plaquemines, St. Helena, and Claiborne) did relatively low crude death rates prevail among the nonwhite populations.

A striking fact evident from a comparison of Figure 4 and Figure 5 is that mortality among the white populations of the various parishes

does not follow the pattern characterizing the nonwhites. The high mortality of the total, rural, and nonwhite populations in the Mississippi River area does not obtain among the whites. In fact, among the whites in this section, very low crude death rates prevail. This indicates that the high crude death rates in this area which have been previously noted are primarily a result of the heavy concentration of nonwhite residents.

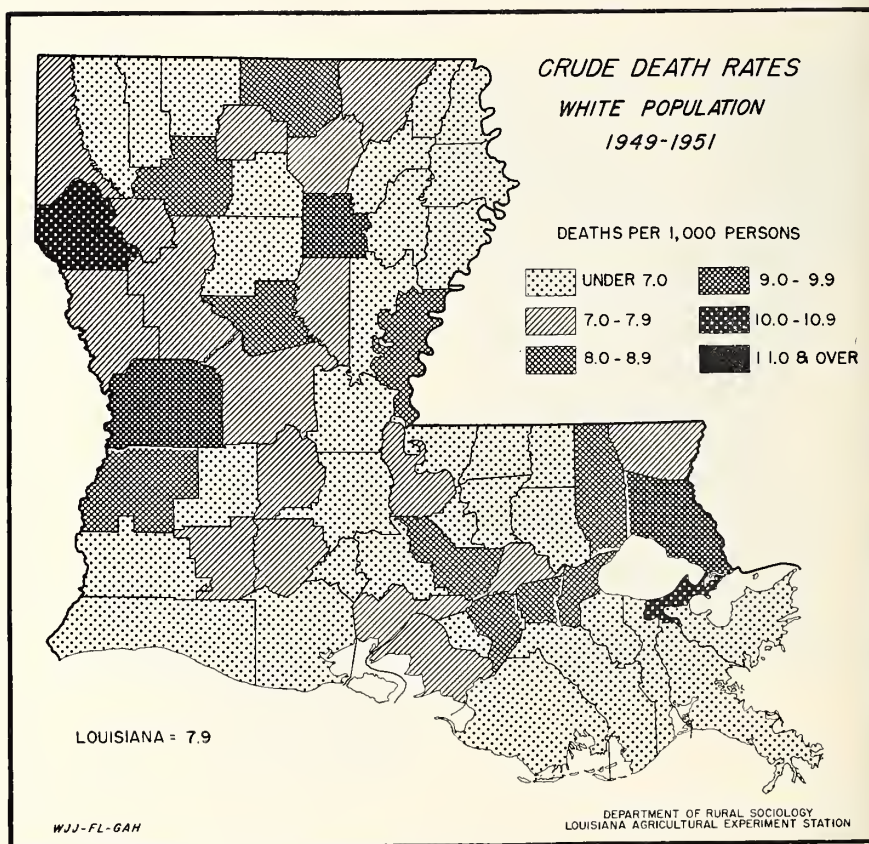


FIGURE 5. Crude Death Rates, White Population, Louisiana, 1949-1951, by Parish.

Figure 5 also shows that the white populations of 32 parishes had crude death rates of less than 7 per 1,000 population. The nonwhite residents of only three parishes had correspondingly low rates. On the other hand, the nonwhite inhabitants of 29 parishes had crude death rates of 11 and above. The white population of not a single parish exhibited a crude death rate of such magnitude.

Mortality among rural Louisianians follows approximately the same pattern as in the total population. This similarity is demonstrated by

Figures 6 and 7. (Appendix Table II.) Figure 6 shows clearly that rural nonwhites were characterized by high crude death rates in essentially the same parishes in which the total nonwhite populations exhibited

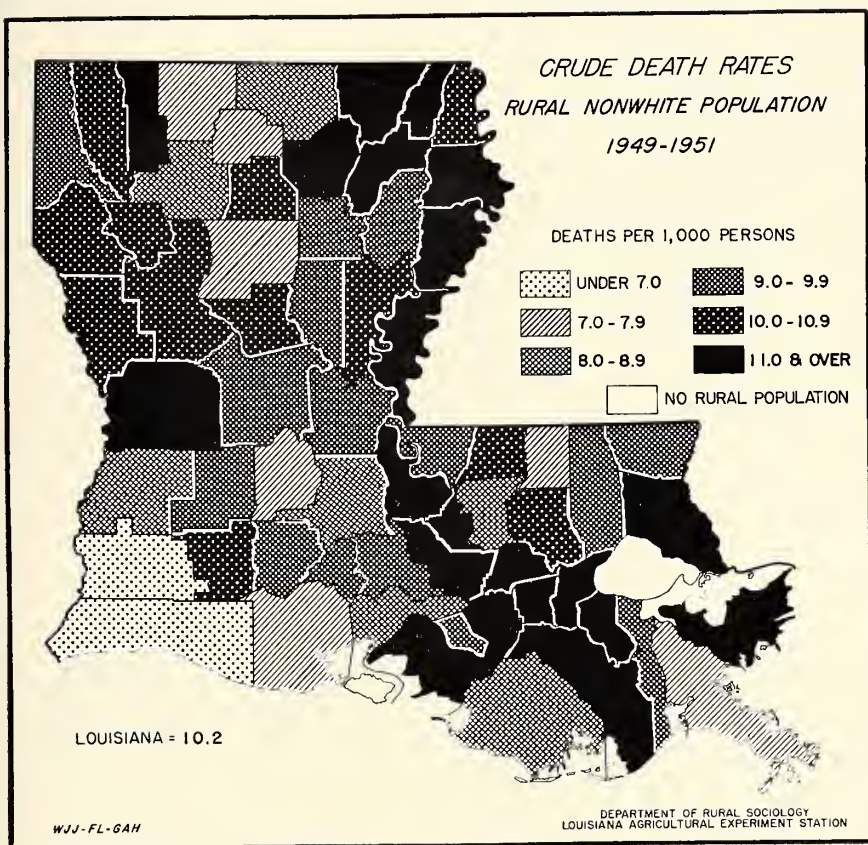


FIGURE 6. Crude Death Rates, Rural Nonwhite Population, Louisiana, 1949-1951, by Parish.

high rates. The same phenomenon holds for the white residents of the state. The main difference that can be observed between the rural and the total populations is that in several parishes, the former has significantly lower death rates than the latter. This differential occurs among both races. For the state as a whole in 1949-1951, the crude death rate of rural nonwhite persons was 10.2 as compared to 11.5 for the total nonwhite population. Corresponding figures for whites were 6.6 and 7.9. On the other hand, within each racial category, the urban dwellers have higher crude death rates than either the rural or total populations. Nonwhites in the cities of the state had a crude death rate of 13.0. The crude

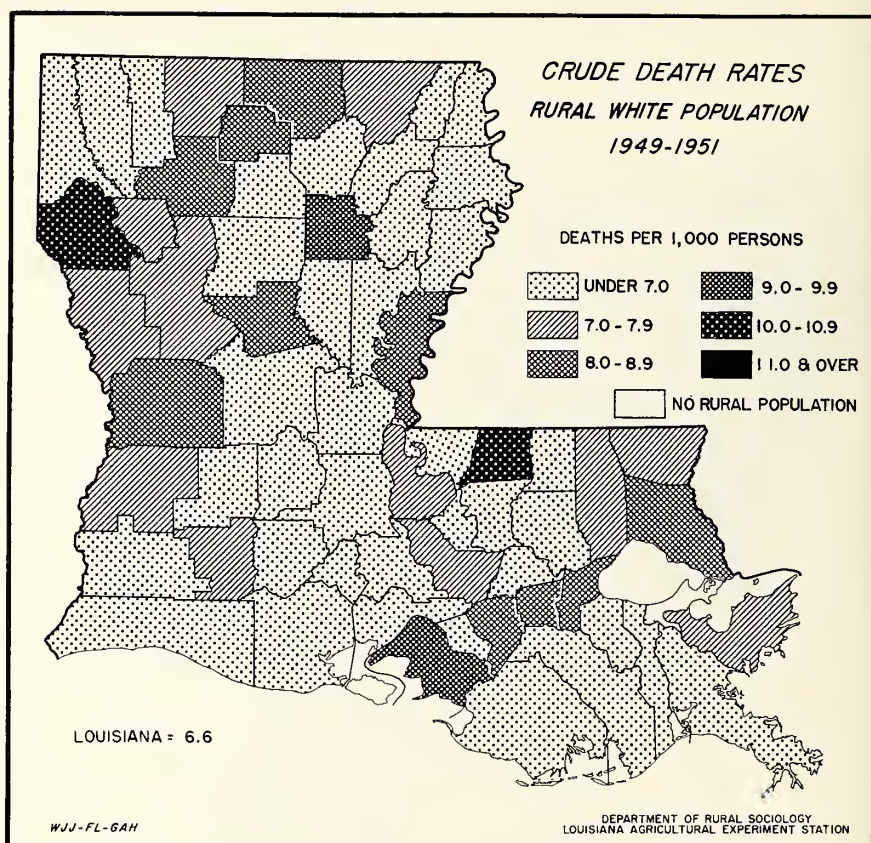


FIGURE 7. Crude Death Rates, Rural White Population, Louisiana, 1949-1951, by Parish.

death rate of urban whites was 9.1 in 1949-1951. Irrespective of race, then, rural residents of the state are characterized generally by lower crude death rates than their urban fellows.

Mortality and Sex Composition

It has long been recognized that a differential in mortality exists between males and females, with the latter having lower rates than the former. This means that an area with a disproportionately high sex ratio (relative excess of males) would as a result be expected to have a higher death rate. In order to demonstrate the relationship of the sex differential in mortality to the variations observed among the parishes, Figures 8 and 9 have been prepared. The male residents of the

parishes which are in the vicinity of the Mississippi River have relatively high crude death rates in a general pattern similar to that of the total population. (See Figure 8.) The main difference appears to be that crude death rates for males tend to be slightly higher than those for

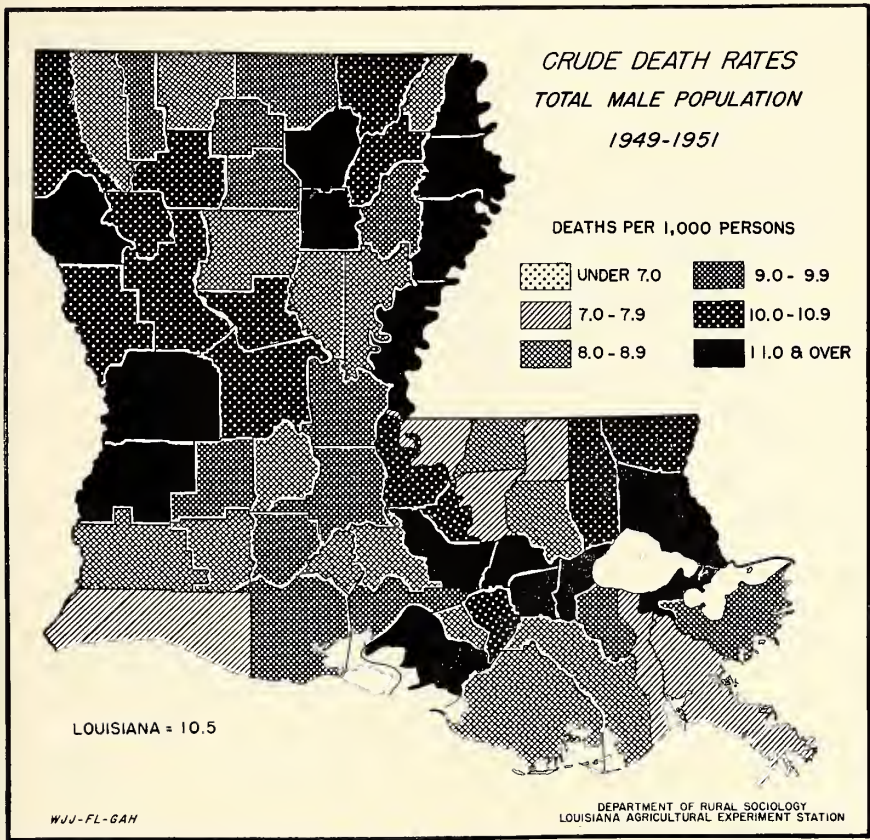


FIGURE 8. Crude Death Rates, Male Population, Louisiana, 1949-1951, by Parish.

the total population. For the entire state in 1949-1951, males died at a rate of 10.5 per 1,000 persons as compared to 9.1 for the total population. The male residents of no parish exhibited a crude death rate of less than 7.0, whereas the total populations of six parishes were characterized by such a low mortality rate. Outside of the Mississippi River area, relatively high death rates among males are found in De Soto, Ouachita, Caldwell, Vernon, Beauregard, St. Mary, and St. Tammany parishes.

A comparison of Figure 8 and Figure 9 demonstrates that in Louisiana the mortality rate among women is consistently lower than that among

men. In fact, this differential prevails in every parish. For the state as a whole in 1949-1951, the crude death rate among males was 10.5 as compared to 7.7 among females. Although the crude death rates for women are consistently lower than those for males in all sections of Louisiana, the

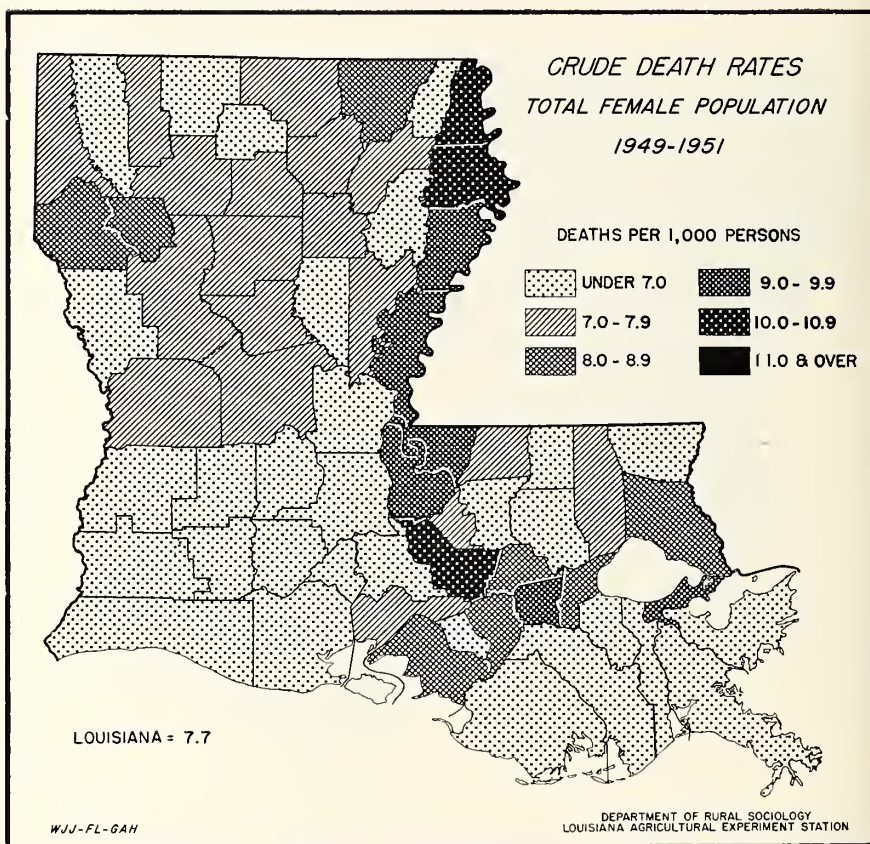


FIGURE 9. Crude Death Rates, Female Population, Louisiana, 1949-1951, by Parish.

pattern of variation among the parishes is similar within each sex group. The highest mortality among women occurs in the parishes in the Mississippi River area in the same manner as among males and the total population. Crude death rates of less than 7 per 1,000 prevailed among the female populations of 29 parishes, whereas the males of not a single parish registered such a low mortality.

Figures 10 and 11 graphically depict the patterns of mortality in 1949-1951 among rural males and rural females. (See Appendix Table III.) A study of these maps reveals that the pattern of geographical

variation in mortality among rural males is similar to that for the total male population; in like manner, the parish variations among rural females approximate those of all females. The fundamental difference is that the rural males and females have generally lower crude death rates than their counterparts in the total population. Rural males in the state had a crude death rate of 9.1 as compared to 10.5 for males in

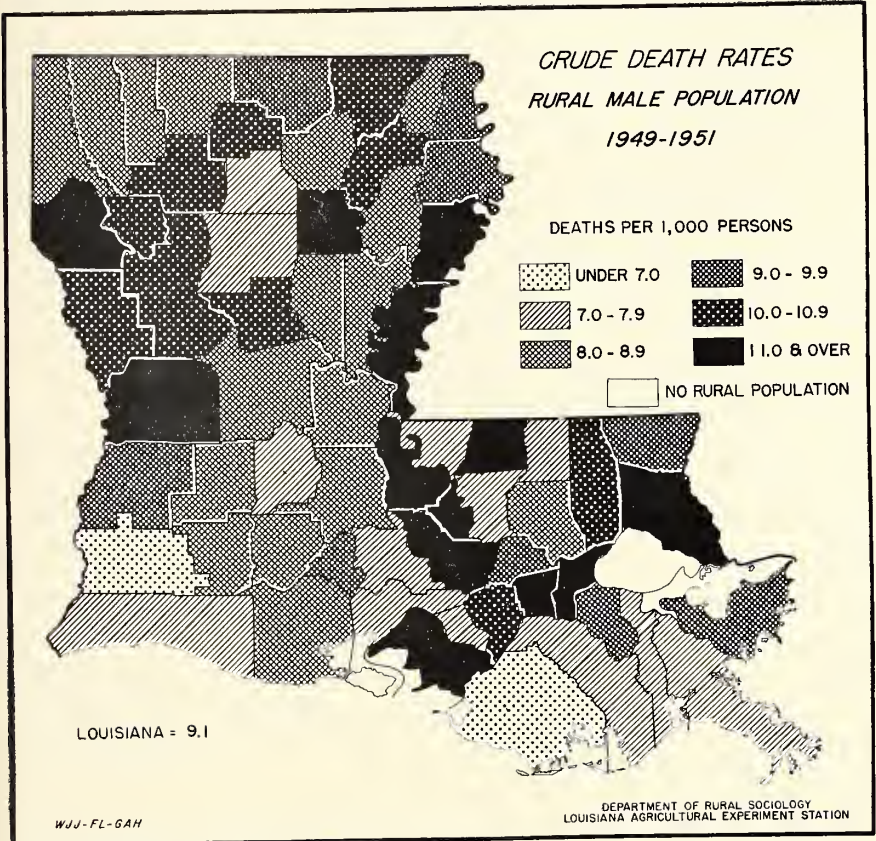


FIGURE 10. Crude Death Rates, Rural Male Population, Louisiana, 1949-1951, by Parish.

the total population. Similar figures for females were 6.7 and 7.7, respectively. Among both males and females in rural areas, the highest rates of death were found in the parishes in the vicinity of the Mississippi River. The rural males of only De Soto, Caldwell, Vernon, St. Mary, St. Tammany, and East Feliciana parishes outside of this area had relatively high rates. At the other extreme, the rural males of two parishes exhibited relatively low crude death rates. These were Calcasieu and Terrebonne, each with less than 7 rural male deaths per 1,000 population. Among rural females of the entire state the rate was only 6.7. In fact,

in 37 parishes crude death rates of less than 7 per 1,000 prevailed among rural women in 1949-1951.

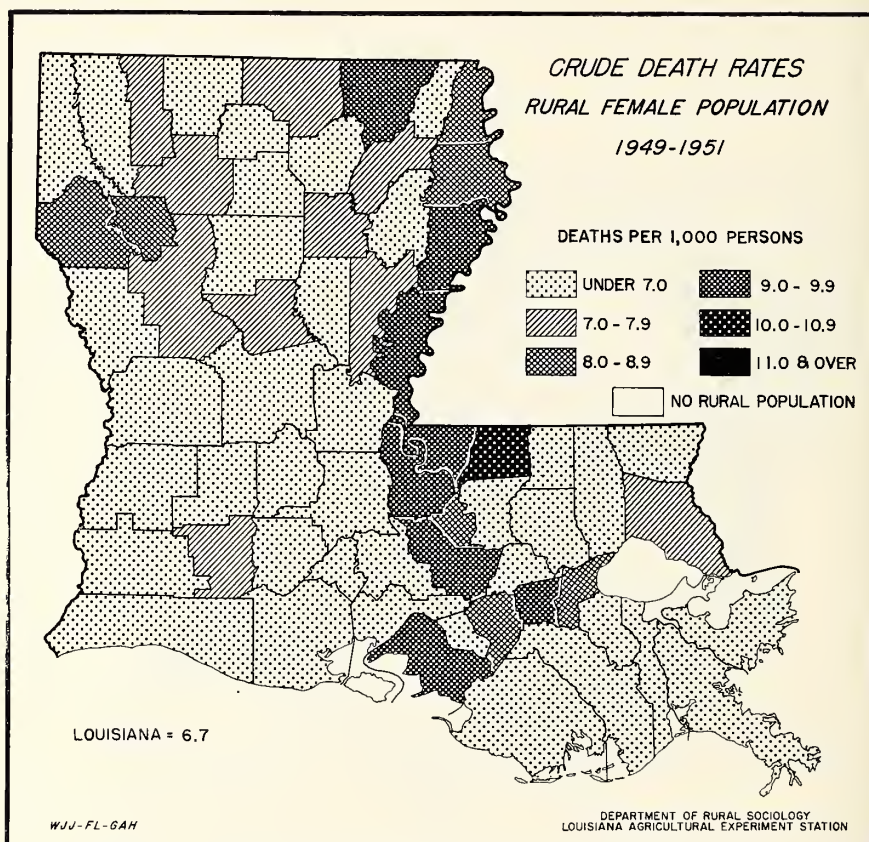


FIGURE 11. Crude Death Rates, Rural Female Population, Louisiana, 1949-1951, by Parish.

Mortality and Age Composition

Another factor which can materially affect the crude death rate is age composition. A population with high proportions of children and old persons is more likely to have a high death rate than one in which there is a disproportionate concentration in the vigorous productive years of life (15-45 years). Therefore, it is possible that the variations in mortality observed among the parishes of Louisiana reflect differential age compositions rather than actual differences in health conditions. In order to provide some basis for evaluating the importance of differences in age structure in determining the pattern of mortality found among Louisiana parishes, death rates have been standardized for age for the total, white, nonwhite, urban and rural populations. (Appendix Table

IV.) For the total population in 1950 the standardized death rate was 9.2 and the crude death rate was 9.1. This indicates that the age structure of the population of Louisiana in 1950 was not very different from that of the standard which was used—the population of the United States in 1940. The age-adjusted rate for the urban population of Louisiana was 10.3, which was exactly the same as the crude death rate; this demonstrates that the age composition of the urban population was not a significant factor in the death rate characterizing that segment of the population. On the other hand, the age-adjusted rate for the rural population was 8.1 as compared with the crude rate of 7.9. This suggests that the age structure of the rural population was a minor factor in determining the low death rate of that category. The general conclusion to be drawn from the use of age-adjusted death rates by residence is that the more favorable mortality experience of rural Louisianians is not due to their age make-up. Differential age structure is only a minor factor in explaining the over-all variations in mortality which exist between rural and urban peoples.

In considering the effect of age structure on the mortality of the white and nonwhite populations, one finds that this factor does not seem to be of great significance in explaining the prevailing variations in death rates. The standardized death rate of the white population in 1950 was 8.0 and the crude death rate was 7.9. Thus, the death rate among whites was very slightly increased by the standardization process. This indicates that the age composition of the white population was such as to account in only small part for the difference in mortality which existed between this group and other segments of the population. When the death rate of the nonwhite population was standardized according to age, no change was observed in the index (11.5). Thus, age composition did not materially influence the crude death rate of this race. It follows that varying age structures of the two races do not explain the differences in mortality setting nonwhites and whites apart.

Figures 12, 13, 14, 15, and 16 show variations in age-adjusted death rates by parish for the total, white, nonwhite, rural, and urban populations in 1950. The population of the United States in 1940 is again used as the standard. A comparison of Figure 12 and Figure 1 (which shows variations in the crude death rates by parish) indicates that the general pattern of mortality is not greatly altered by the process of standardization for age. In fact, the high standardized death rates are found adjacent to and near the Mississippi River in the same manner as the high crude death rates. Although the general pattern of mortality does not appear to result to any large extent from differences in age structure of the various parish populations, certain of them do have age compositions which influence the death rate to a considerable degree. Thus, among the total populations, the standardization for age increased the rate of mortality as much as 1 death or more per 1,000 persons in nine parishes. These are Bossier, Calcasieu, East Baton Rouge, Evangeline, Jefferson,

Lafayette, Lafourche, St. Bernard, and St. Landry parishes. This means that had the age structure of these parishes been the same as that of the standard population, the death rate would have been greater by 1 or

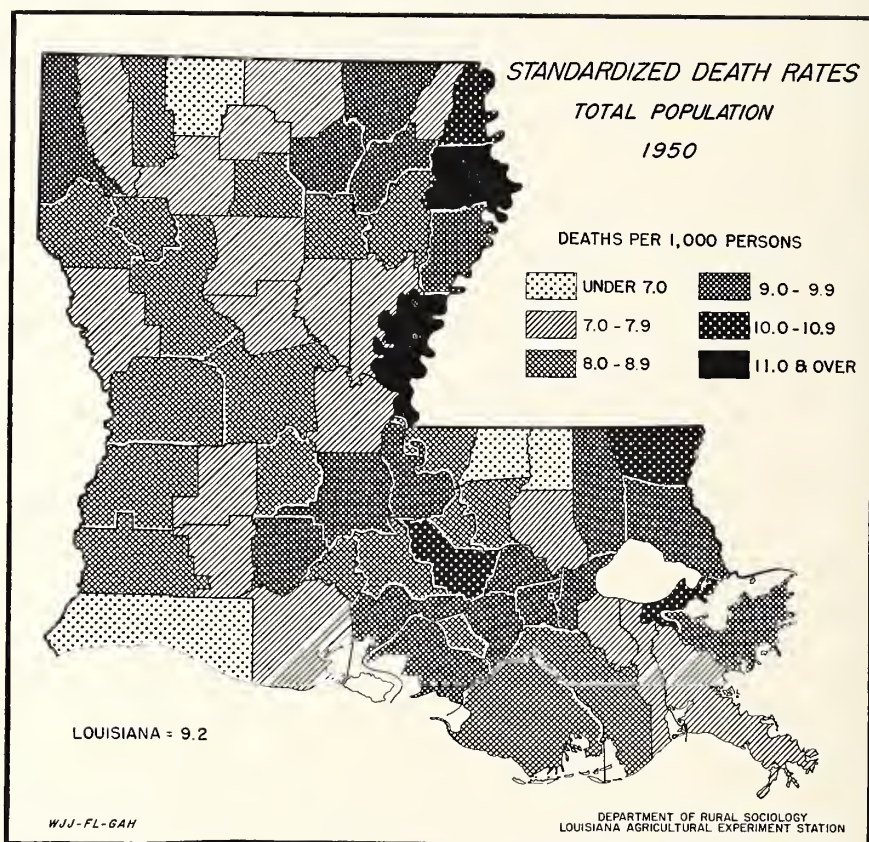


FIGURE 12. Standardized Death Rates, Louisiana, 1950, by Parish.

more deaths per 1,000 persons. Such a circumstance suggests that the age structure of these parishes is such as to be conducive to low mortality, and thus is a factor in explaining the relatively low crude rates prevailing in these parishes. It is of interest that all of these parishes except Bossier are located in the southern part of the state.

In contrast to the above situation, the process of standardization for age tended to significantly decrease the death rates of eleven parishes. (The decrease amounted to 1 or more deaths per 1,000 persons.) Caldwell, De Soto, East Carroll, East Feliciana, Grant, Iberville, Red River, St. James, St. Tammany, Tensas, and Vernon parishes are included in this category. This can be interpreted to mean that the age structures of the populations of these parishes are conducive to a high death rate. Age, thus, should be considered in explaining the differences which exist

in mortality between these and other parishes. In the remaining 44 parishes, the standardization of the death rate for age did not significantly alter the rates. This suggests that the age structure of the residents of these parishes was not a significant factor in accounting for the differences which existed in mortality between these and the other parishes.

The variations in the standardized death rates of the white population by parish in 1950 are presented in Figure 13. A comparison of this

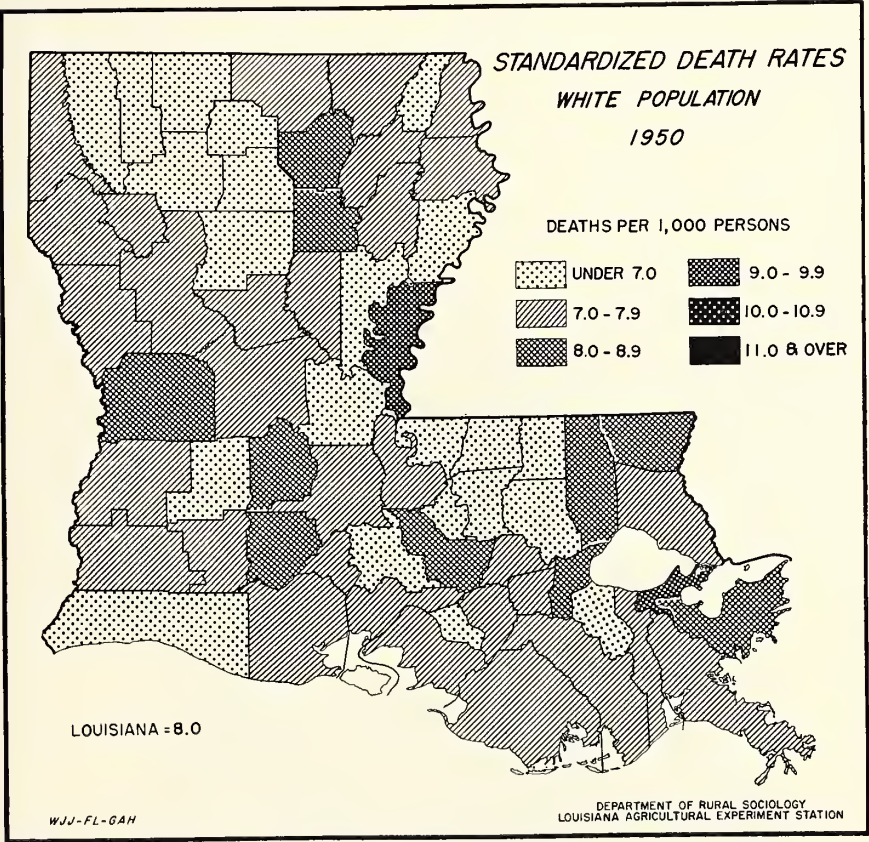


FIGURE 13. Standardized Death Rates, White Population, Louisiana, 1950, by Parish.

map and Figure 5 (which shows the parish variations of the crude death rates among whites) indicates that the mortality pattern is only moderately altered by the process of adjusting for differential age structures. If anything, the standardization for age seems to have a general tendency to increase the death rates for whites; however, only in a limited number of cases is this increase very significant. The data show that adjusting the rate for age structure increased it 1 or more deaths per 1,000 persons among the white populations of nine parishes. These were

Bossier, Calcasieu, Concordia, East Baton Rouge, East Carroll, Jefferson, St. Bernard, St. Landry, and Terrebonne. In these parishes, the age composition of the white populations is such as to be conducive to a low mortality. It should consequently be considered as a significant factor in explaining the differences in mortality among the whites of these parishes as compared to those in the remainder of the state.

Adjusting the death rate for differential age structures of the white population decreased the rate 1 or more deaths per 1,000 persons in eight parishes. These were Bienville, Claiborne, De Soto, East Feliciana, Grant, Orleans, St. Tammany, and Union parishes. This suggests that the age structure of the white populations of these parishes is favorable to a high mortality. Age structure, therefore, should be viewed as an important factor in accounting for the differences in mortality among whites in these parishes and those in other parishes of the state.

The age-adjusted death rates for the nonwhite population by parish are presented in Figure 14. Again, a comparison of this map with the

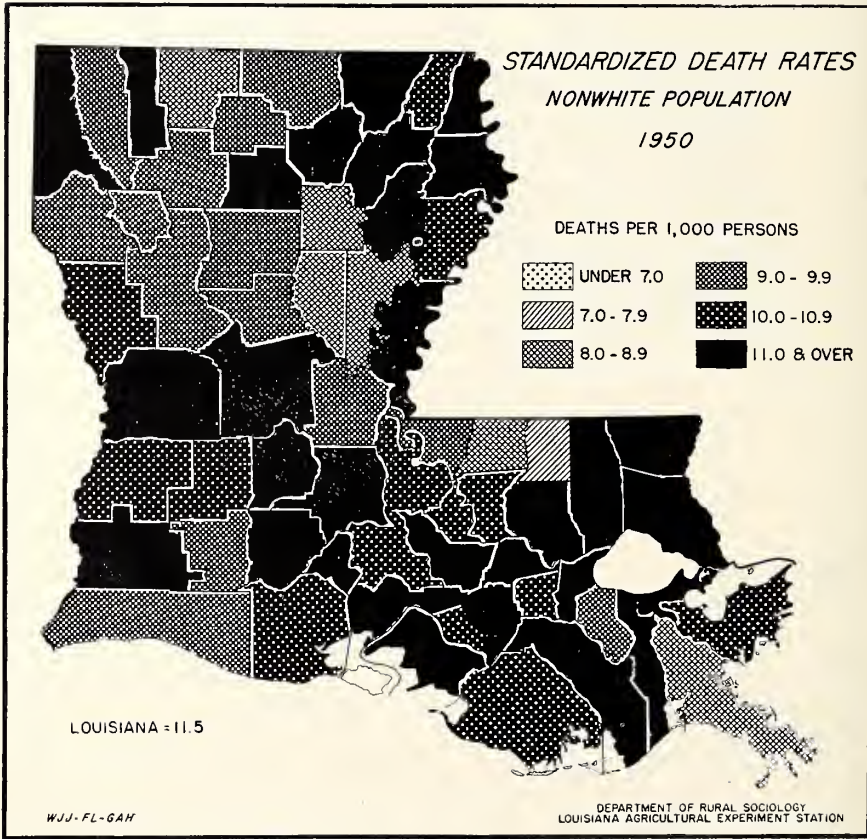


FIGURE 14. Standardized Death Rates, Nonwhite Population, Louisiana, 1950, by Parish.

one which shows similar variations in crude death rates (Figure 4) does not indicate any radical changes in pattern although considerable modification is noted. A study of the changes wrought in the death rates of the various parishes through the process of standardization for age structure shows that the death rate of the nonwhites was decreased 1 or more deaths per 1,000 persons in 23 parishes. (Ascension, Beauregard, Caldwell, Cameron, Catahoula, Concordia, De Soto, East Carroll, East Feliciana, Grant, Iberville, La Salle, Madison, Natchitoches, Pointe Coupee, Red River, St. Charles, St. James, St. Mary, Tensas, Vernon, West Baton Rouge, and West Carroll). This indicates that the age structure of these parishes was significant in bringing about the crude death rate which prevailed because it was conducive to a high mortality experience. On the other hand, the age structures of the nonwhite populations of 13 parishes appeared to be favorable to a low mortality experience. In Acadia, Calcasieu, Evangeline, Jackson, Jefferson, Lafayette, Lincoln,

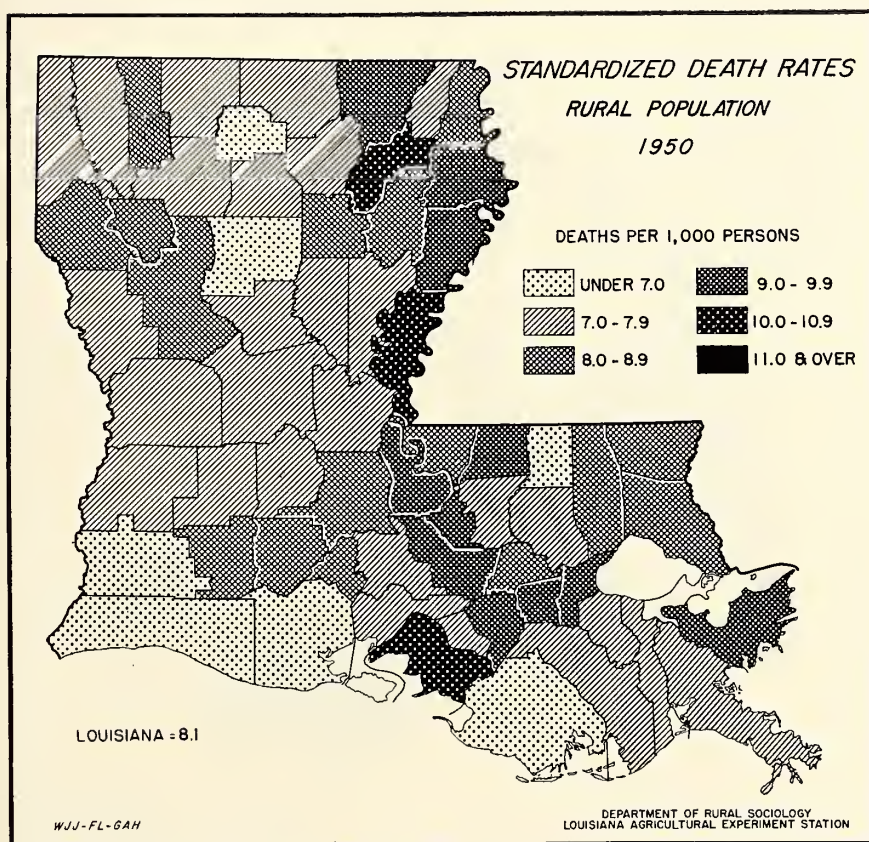


FIGURE 15. Standardized Death Rates, Rural Population, Louisiana, 1950, by Parish.

Livingston, Plaquemines, St. Landry, St. Martin, Tangipahoa, and Webster parishes, the standardization for age increased the death rate by 1 or more deaths per 1,000 persons.

An analysis of the variations in the standardized death rates of the rural populations of the different parishes also does not indicate any marked change in the pattern of mortality. Those parishes with the high standardized death rates are located in the Mississippi River area in the same sort of pattern as are the parishes with high crude death rates. (Compare Figure 15 and Figure 2.) If any generalization is to be made, it is that standardization for age reduces the death rates of the rural populations of the parishes. In fact, the standardized death rate was significantly higher than the crude death rate (1 or more deaths per 1,000 persons) in only eight parishes. These were Acadia, Calcasieu, Evangeline, Iberia, Jefferson, Lafourche, St. Bernard, and St. Landry parishes. It may be assumed that the age make-up of the rural popula-

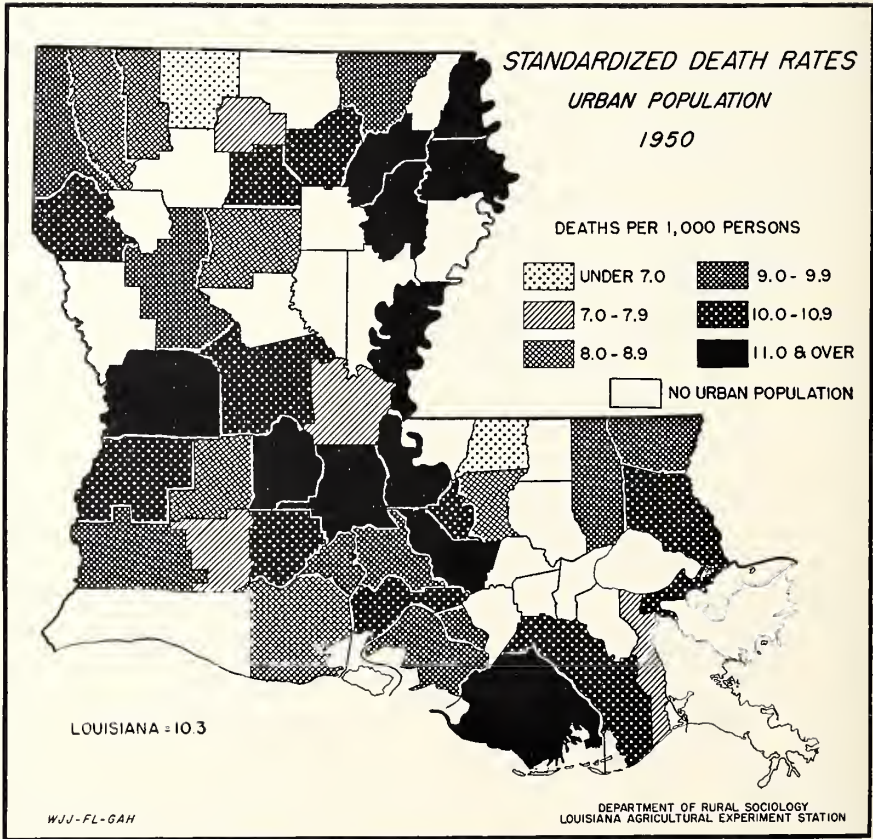


FIGURE 16. Standardized Death Rates, Urban Population, Louisiana, 1950, by Parish.

tion of these parishes was conducive to a low mortality experience. On the other hand, standardization for age composition lowered the death rate 1 or more deaths per 1,000 population in eleven parishes. Included among these were Bienville, Caldwell, De Soto, East Feliciana, Grant, Iberville, Red River, St. James, St. Tammany, Tensas, and Union parishes. It seems likely that the age structure of the rural populations of these parishes is a factor to be considered in explaining their level of mortality.

Among the urban population, no major alteration in the pattern of mortality among the parishes resulted from standardization of death rates for age. In other words, the parishes with high crude death rates are generally the ones with high standardized death rates. (Compare Figure 16 and Figure 3.) The age structure appears to be a significant factor conducive to a low mortality experience among the urban populations of only Bossier, Calcasieu, East Baton Rouge, Evangeline, Jefferson, Lafayette, and Morehouse parishes. In these parishes, the process of age standardization increased the death rate 1 or more deaths per 1,000 persons. In Ascension, Concordia, East Carroll, Franklin, Iberville, Madison, Richland, and St. Tammany parishes, this process decreased the death rate among the urban populations by 1 or more deaths per 1,000 persons. This can be interpreted to mean that the age structures of the urban populations of these parishes contribute to a high mortality experience.

CAUSES OF DEATH

The causes of death among the residents of Louisiana during 1949-1951 did not differ significantly from causes of death among the people in the nation as a whole. The main killers of Louisianians are diseases of the heart, cancer, and vascular lesions affecting the central nervous system, in that order. In 1949 these three diseases held exactly the same ranking as killers of Louisiana's people as they did for the population of the United States.⁶ Table II presents the ten principal causes of death in Louisiana by race for 1949-1951. A rather surprising fact noted from these data is that the leading causes of death among nonwhites are the same as those for the general population and for whites. A casual observer might logically deduce that the contagious or transmissible diseases would compare in importance with heart disease, cancer, etc., as causes of death among the nonwhite population. Even though transmissible diseases are much more important as causes of death among nonwhites than among whites, the three greatest killers among both races are heart disease, cancer, and vascular lesions affecting the central nervous system.

⁶ *Vital Statistics of the United States*, 1949, Federal Security Agency, Public Health Service, National Office of Vital Statistics, Part III, Table 21.

Tuberculosis accounted for slightly less than three times as many deaths among nonwhites; and syphilis, which has been reduced to the relatively insignificant number of 3 deaths per 100,000 population among whites,

TABLE II. — The Ten Leading Causes of Death, Louisiana, 1949-1951, by Race

Causes of Death*	Deaths per 100,000 population					
	Total Population		Whites		Nonwhites	
	Rate	Rank	Rate	Rank	Rate	Rank
Diseases of the heart (410-443)	312.5	(1)	294.2	(1)	349.4	(1)
Cancer (140-205)	120.6	(2)	121.7	(2)	118.5	(3)
Vascular lesion affecting the central nervous system (330-334)	87.5	(3)	69.0	(4)	125.2	(2)
Violent or accidental death (800-999)	79.5	(4)	73.7	(3)	91.3	(5)
Congenital malformation and diseases of the first year of life (750-776, excluding 763)	71.1	(5)	54.3	(5)	105.0	(4)
Influenza and pneumonia (480-483, 490-493, 763)	36.2	(6)	22.7	(7)	63.6	(6)
Diseases of the digestive system (530-587, excluding 550-553)	31.1	(7)	27.9	(6)	37.4	(8)
Tuberculosis (001-008, 010-019)	27.7	(8)	19.9	(8)	43.5	(7)
Nephritis (590, 592)	16.0	(9)	12.0	(9)	24.1	(9)
Diabetes Mellitus (260)	11.8	(10)	10.8	(10)	13.8	—
Syphilis (020-029)	9.4	—	3.0	—	22.4	(10)

Source: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951, Table XI.

* Numbers under the causes of death are category numbers of the Sixth Revision of the International Lists, 1948.

accounted for about eight times that number of deaths among nonwhite persons. Diseases of the heart, which is the major cause of death among both whites and nonwhites, actually took a higher toll of lives among the latter in 1949-1951 than among the former, 294.2 as compared to 349.4 deaths per 100,000 persons. The death rate for cancer was about the same for both races, 121.7 for whites and 118.5 for nonwhites. However, in 1949-1951 proportionately almost twice as many nonwhites as whites died from vascular lesions affecting the central nervous system, the rates being 125.2 compared to 69.0, respectively. Indeed, this disease holds second place as a killer of nonwhites during 1949-1951.

The above observations support the contention that nonwhites die at a greater rate from transmissible diseases than do Louisiana whites; but they also show that the degenerative diseases are the major causes of death, and in some cases rates among nonwhites are actually higher than those of whites. The greater mortality experience of the nonwhites as compared to the whites can be rightfully attributed to the excessive death rate due to contagious diseases which are controllable. Further reduction in the general death rate among nonwhites will undoubtedly occur as the transmissible diseases are brought under the same controls among them as among whites. The interesting thing which is herein revealed is that, contrary to the beliefs of many lay persons, the degenerative diseases are not principally problems of the white population because of their increased expectation of life and the greater complexity of their way of life. The data definitely show that these diseases take an equal or even greater toll among nonwhites who have shorter expectations of life.

An examination of causes of death during 1946-1948 by residence indicates that persons living in the only totally urban parish of the state (Orleans) had higher crude death rates from the degenerative diseases than did the inhabitants of the other residence categories.⁷ (See

⁷ The Louisiana State Department of Health and the Bureau of Vital Statistics do not present these data according to the usual residence categories of urban, rural nonfarm, and rural farm. However, they do provide data concerning specific causes of death for the individual parishes. In order to isolate the residence factor, the authors have classified the parishes according to their degree of rurality. This gives a classification of four groups; the totally urban, the semi-urban, the semi-rural, and the totally rural parishes. The totally urban parish (Orleans), of course, has no rural people and represents a completely urban situation. The semi-urban parishes are those which have more than half of their populations classified as urban, and the semi-rural ones have more than half of their people classified as rural. The totally rural parishes, of course, have no urban population and represent a completely rural situation. The divisions of the parishes are as follows: (1) *Totally urban*: Orleans. (2) *Semi-urban*: Caddo, Calcasieu, East Baton Rouge, Iberia, Jefferson, Lafayette, Ouachita, and St. Mary. (3) *Semi-rural*: Acadia, Allen, Ascension, Avoyelles, Beauregard, Bossier, Claiborne, Concordia, De Soto, East Carroll, East Feliciana, Evangeline, Franklin, Iberville, Jackson, Jefferson Davis, Lafourche, Lincoln, Madison, Morehouse, Natchitoches, Pointe Coupee, Rapides, Richland, St. Landry, St. Martin, St. Tammany, Tangipahoa, Terrebonne, Vermilion, Vernon, Washington, Webster, West Baton Rouge, and Winn. (4) *Totally rural*: Assumption, Bienville, Caldwell, Cameron, Catahoula, Grant, La Salle, Livingston, Plaquemines, Red River, Sabine, St. Bernard, St. Charles, St. Helena, St. John the Baptist, St. James, Tensas, Union, West Carroll, and West Feliciana. The definitions of urban and rural residence as used in the 1940 Census are the bases of the above classifications.

In order to work out a three-year average for these specific causes of death, it was necessary to use the period 1946-1948 instead of 1947-1949 (the latest available Vital Statistics Reports) because of the revision of the International List of Causes of Death which was incorporated into the 1949 reports.

Table III.) Death rates due to diseases of the heart, cancer, and intra-cranial lesions of vascular origin were higher in Orleans Parish than in any other residential category. The death rate due to diseases of the heart was 376 per 100,000 population in Orleans Parish as compared to 206 in the semi-urban, 242 in the semi-rural, and 222 in the totally rural parishes. The death rate due to cancer followed a similar pattern. This rate was 150 in the totally urban, 92 in the semi-urban, 91 in the semi-rural, and 89 in the totally rural parishes. The totally urban parish had a significantly higher death rate due to intra-cranial lesions of vascular origin than did the other residence categories. Its rate of 86 per

TABLE III. — Selected Causes of Death, Louisiana, 1946-1948, by Residence
(Rates per 100,000 Population)

Disease*	The State		Parishes							
			Totally Rural		Semi-Rural		Semi-Urban		Totally Urban	
	Rate	Rank	Rate	Rank	Rate	Rank	Rate	Rank	Rate	Rank
Diseases of the heart										
(90-95)	259	(1)	222	(1)	242	(1)	206	(1)	376	(1)
Cancer										
(45-55)	103	(2)	89	(2)	91	(2)	92	(2)	150	(2)
Intra-cranial lesions of vascular origin										
(83)	74	(3)	75	(3)	73	(3)	65	(4)	86	(3)
Congenital mal-formation and diseases of the first year										
(157-161)	71	(4)	63	(4)	72	(4)	71	(3)	71	(4)
Nephritis										
(130-132)	56	(5)	47	(6)	52	(6)	59	(5)	68	(5)
Pneumonia and influenza										
(107-109, 33)	49	(6)	48	(5)	54	(5)	42	(6)	47	(7)
Tuberculosis										
(13-22)	39	(7)	25	(7)	37	(7)	32	(7)	58	(6)
Motor vehicle accidents										
(170)	20	(8)	23	(8)	21	(8)	19	(8)	16	(10)
Diabetes										
(61)	16	(9)	12	(9)	13	(10)	15	(9)	26	(8)
Syphilis										
(30)	16	(10)	9	(10)	19	(9)	10	(10)	21	(9)

Source: *Vital Statistics of the United States, 1946, 1947, 1948*, Federal Security Agency, Public Health Service, National Office of Vital Statistics, Washington, D. C., Part II.

* Numbers refer to the 1938 revision of the detailed International List of Causes of Death.

100,000 population ranked highest, the totally rural parishes (75) ranked second, the semi-rural (73) ranked third, and the semi-urban (65) had the lowest rate due to this cause. The residents of the totally urban parish (Orleans) also had substantially higher death rates from nephritis, tuberculosis, diabetes, and syphilis than the people of the other residential classifications.

The highest death rate from pneumonia and influenza prevailed in the semi-rural parishes, and the highest rate due to motor vehicle accidents was recorded in the totally rural ones. This latter fact is interesting in view of the general assumption that the heavy automobile movement in cities constitutes the greatest hazard of death from motor vehicle mishaps. The highest death rate for none of these specific diseases or conditions occurred in the semi-urban parishes.

The residents of the totally rural parishes had the lowest death rates from cancer, congenital malformation and diseases of the first year of life, nephritis, tuberculosis, diabetes, and syphilis. The semi-rural parishes did not rank lowest insofar as death rates with respect to any of these specific causes of death are concerned. The people of the semi-urban parishes, on the other hand, had the lowest rates for pneumonia and influenza, intra-cranial lesions of vascular origins, and diseases of the heart. The inhabitants of the totally urban parish (Orleans) had the lowest death rate only for motor vehicle accidents.

These data indicate that the causes of death vary somewhat in importance between the rural and urban classifications. However, insofar as rank order of importance is concerned, there is little difference among the various residence categories. Diseases of the heart, cancer, and intra-cranial lesions of vascular origin are the leading causes of death in all residence categories except the semi-urban parishes, in which the latter one ranks fourth. In this group of parishes, congenital malformation and diseases of the first year of life ranks third.

Variations in death rates from specific causes among the individual parishes are of interest to many people in the state. In order to show such variations in 1946-1948 for the three leading causes of death, diseases of the heart, cancer, and intra-cranial lesions of vascular origin, Figures 17, 18, and 19 have been prepared. (Also see Appendix Table V.) In 1946-1948, death rates due to diseases of the heart varied from 104.9 per 10,000 population in East Feliciana Parish to a low of 9.8 per 10,000 in Red River Parish. The extremely high figure for East Feliciana Parish should not be viewed with alarm, because it is distorted by deaths occasioned by diseases of the heart among persons institutionalized at the State Mental Hospital located in the parish.⁸ Orleans Parish with a rate

⁸ Through 1948 the *Vital Statistics* of the United States did not reallocate deaths of persons in institutions where length of stay is usually long, such as mental institutions, orphanages, homes for the aged, blind, and deaf, etc. This procedure was changed in 1949.

of 37.6 per 10,000 persons had the next highest rate and Tensas Parish followed closely behind with a rate of 37.2. These figures indicate that proportionately nearly four times as many residents of Orleans Parish as of Red River Parish succumbed to diseases of the heart during this period. Other parishes which had high death rates from this cause were

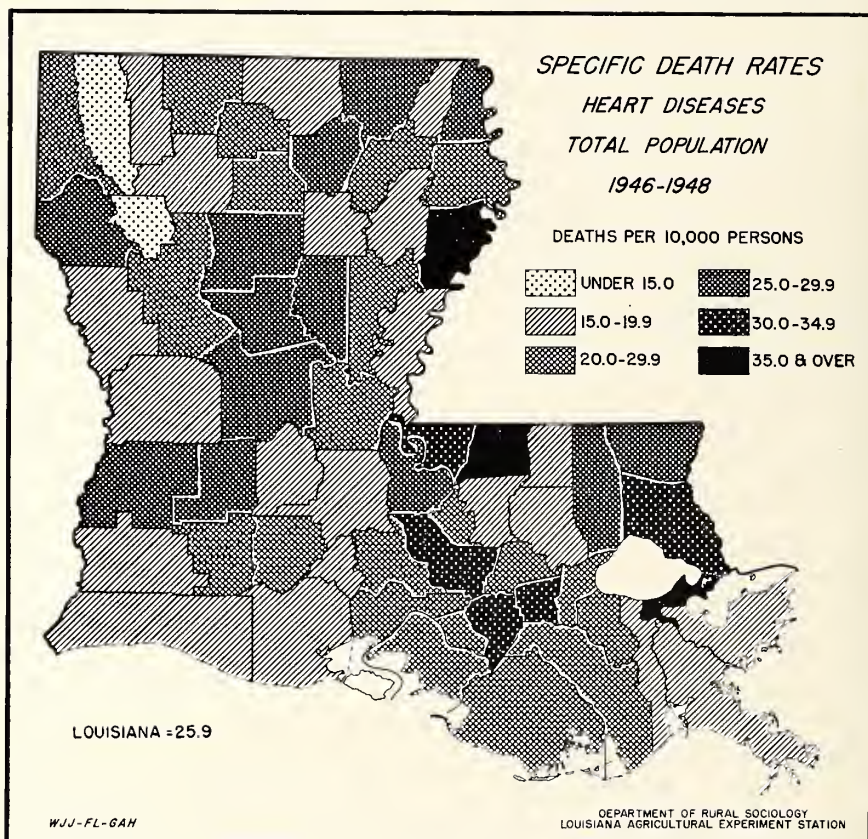


FIGURE 17. Specific Death Rates due to Diseases of the Heart, Louisiana, 1946-1948, by Parish.

Assumption (32.3), West Feliciana (32.2), St. James (31.2), St. Tammany (30.9), and Iberville (30.4). No other parish had a rate of over 30 deaths per 10,000 population. Low death rates from diseases of the heart were found in Calcasieu (19.1), St. Landry (19.0), Concordia (18.7), Caldwell (18.6), East Baton Rouge (18.3), Plaquemines (18.3), Livingston (18.2), West Carroll (18.1), Webster (18.0), Vernon (17.9), Union (17.8), Lafayette (17.7), St. Helena (17.5), Bienville (17.5), Jefferson (17.1), Cameron (16.9), Evangeline (16.8), Sabine (16.6), Franklin (15.9), and Bossier (13.1) parishes. In no other parish was a

rate of less than 20 deaths per 10,000 persons from diseases of the heart reported.

During the same period, death rates due to cancer varied from 15.0 per 10,000 population in Orleans Parish to 3.1 in Cameron Parish. Thus, proportionately, almost five times as many residents of Orleans as of Cameron Parish died from cancer in the three-year interval. Pointe Coupee Parish was also characterized by a high rate of death due to this

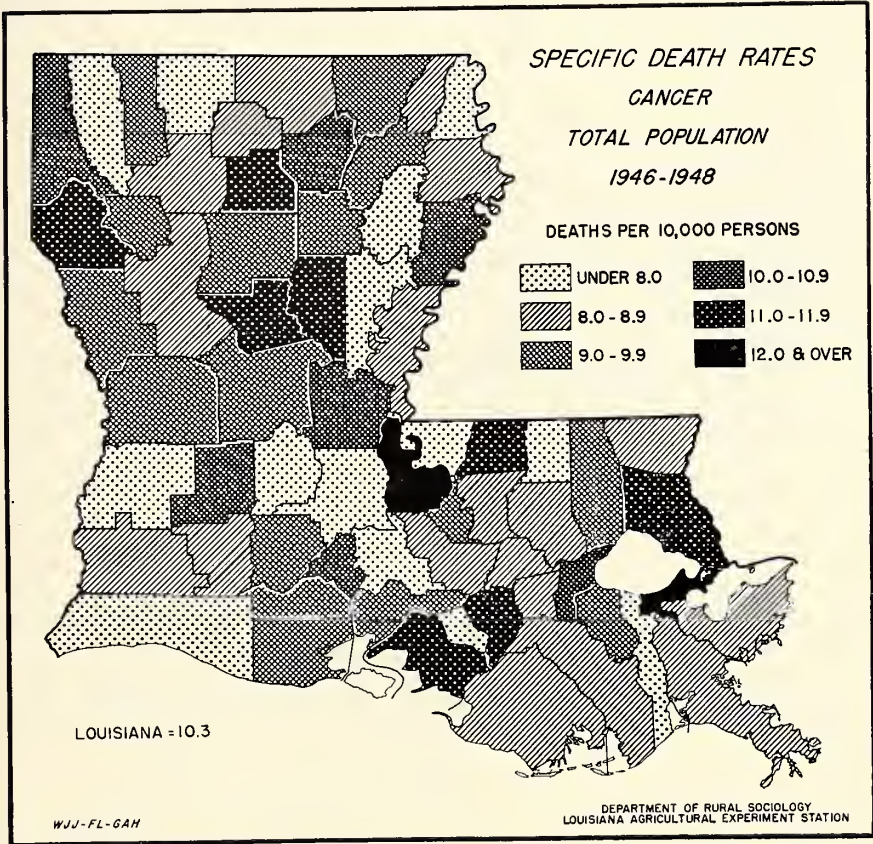


FIGURE 18. Specific Death Rates due to Cancer, Louisiana, 1946-1948, by Parish.

disease (12.9). No other parish had a rate of 12 or more. Relatively high rates were found in Assumption (11.9), Jackson (11.8), East Feliciana (11.7), Grant (11.5), La Salle (11.5), St. Tammany (11.5), De Soto (11.2), and St. Mary (11.0) parishes. Death rates due to cancer in all other parishes were less than 11 per 10,000 population.

St. Helena Parish, with the very low cancer death rate of 3.3 per 10,000 persons, ranked next to Cameron (3.1) at the other end of the

scale. Death rates due to cancer of less than 8 per 10,000 people prevailed in thirteen parishes. Besides the two listed above, Claiborne (7.9), Evangeline (7.9), St. Landry (7.7), Beauregard (7.7), St. Martin (7.6), West Feliciana (7.6), Bossier (7.3), Catahoula (7.1), Jefferson (7.0), West Carroll (6.8), and Franklin (6.6) parishes had rates falling within that category.

Death rates due to intra-cranial lesions of vascular origin, the third most important cause of mortality in Louisiana, also varied widely among the several parishes. The highest death rate from this cause in 1946-1948 was that of 14.2 per 10,000 population in Catahoula Parish. In

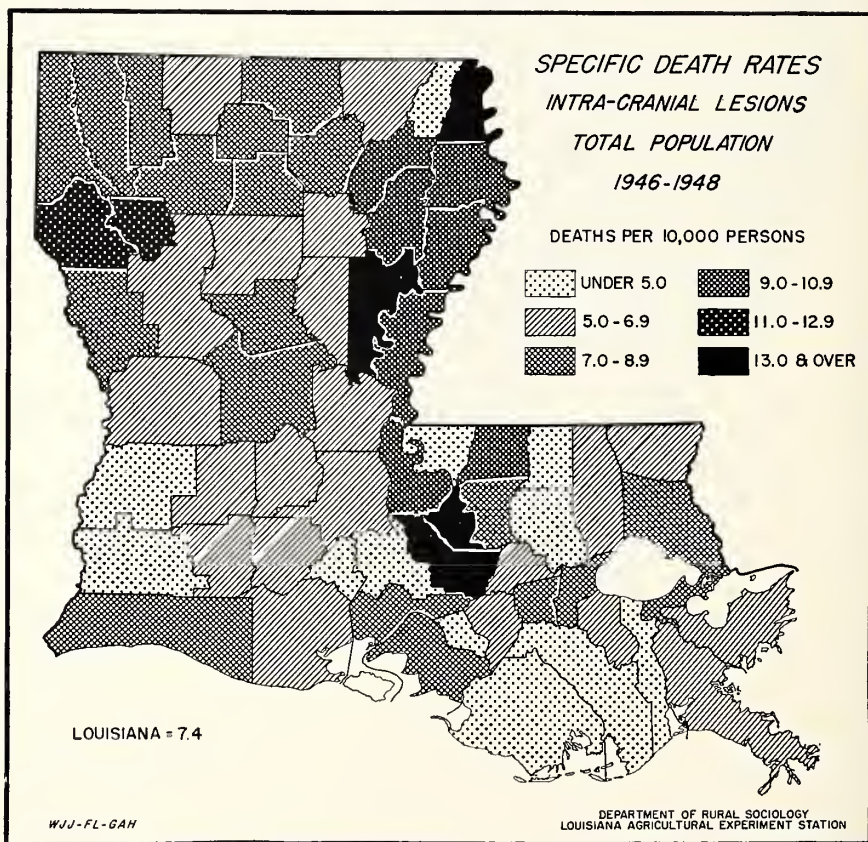


FIGURE 19. Specific Death Rates due to Intra-cranial Lesions of Vascular Origin, Louisiana, 1946-1948, by Parish.

contrast, the lowest rate (3.3 deaths per 10,000 persons) was found in Jefferson Parish. The other 62 parishes were unevenly distributed between these two extremes. Among the parishes with relatively high

rates from this cause, besides Catahoula, were Iberville (14.1), East Carroll (14.0), and West Baton Rouge (13.9). Although no other parish had a rate of 13 deaths or more per 10,000 population, two did have rates above 11 per 10,000 persons. These were Red River (12.1) and De Soto (11.2) parishes.

Death rates due to intra-cranial lesions of vascular origin of less than 5 per 10,000 population in 1946-1948 prevailed in eleven parishes. Besides Jefferson, these were Terrebonne (4.9), Calcasieu (4.8), West Feliciana (4.7), Lafourche (4.7), West Carroll (4.5), St. Helena (4.4), Lafayette (4.3), Livingston (4.2), Beauregard (4.2), and St. Martin (3.4) parishes.

TRENDS IN MORTALITY, 1940-1950

The available data indicate that the crude death rate of the total population of the state declined from 10.8 in 1940 to 9.1 in 1950. However, an inspection of Table IV shows that the rate of decline differed significantly among the various groups composing the state's population. It is evident that the decline in the crude death rate of rural dwellers was much less than the decrease recorded by urban residents and by the people of the state as a whole. The rural crude death rate declined only slightly between 1940 and 1950, from 8.7 to 7.8, respectively. Comparable figures for the urban population are 13.7 and 10.2, respectively.

**TABLE IV. — Crude Death Rates, Louisiana, 1940 and 1950,
By Race, Residence and Sex***

RACE AND SEX	LOUISIANA		URBAN		RURAL	
	1940	1950	1940	1950	1940	1950
TOTAL	10.8	9.1	13.7	10.2	8.7	7.8
Males	12.2	10.5	15.9	11.9	9.7	9.0
Females	9.5	7.6	11.7	8.6	7.8	6.6
WHITES	9.2	7.8	11.7	9.0	7.1	6.6
Males	10.5	9.4	13.7	10.8	8.1	7.9
Females	7.7	6.3	9.8	7.2	5.9	5.3
NONWHITES	13.8	11.4	17.9	13.0	11.4	10.0
Males	15.2	12.7	20.7	14.6	12.2	11.1
Females	12.5	10.2	15.6	11.5	10.6	8.9

Sources: *Vital Statistics of the United States, 1940, Part II*, United States Government Printing Office, Washington, 1943.

Sixteenth Census of the United States: 1940, *Population: Vol. II, Characteristics of the Population*, United States Government Printing Office, Washington, 1943.

Statistical Report of the Division of Public Health Statistics, Louisiana State Department of Health, 1950.

United States Census of 1950 Population: *Louisiana, Number of Inhabitants*, Report P-A18 Reprint of Volume 1, Chapter 18.

* The old census definition of urban is used in computing these rates.

The significance of these figures is that the rural death rate probably is nearing its lowest possible level and probably will tend to rise slightly in the future as aged persons come to constitute a larger proportion of the rural population. These data also indicate that the urban people of the state are rapidly reducing the magnitude of their death rates. The differential in mortality favoring rural people should eventually disappear.

An examination of trends in mortality by race shows that both whites and nonwhites in the state were characterized by a decline in death rates between 1940 and 1950. For the state as a whole, these decreases were from 9.2 to 7.8 deaths per 1,000 persons for whites and from 13.8 to 11.4 deaths per 1,000 persons for nonwhites. These data indicate that both races have made improvements in health conditions during the decade under consideration. However, an analysis of trends in mortality by race according to residential status shows that most of the gain has occurred among whites and nonwhites in urban localities. The death rate of urban whites in the state declined from 11.7 to 9.0 per 1,000 population during the ten years being studied. Rural whites, on the other hand, recorded only a very slight decrease in the death rate, 7.1 in 1940 to 6.6 in 1950. Urban nonwhites showed a much greater decline in the death rate than urban whites. The rate in 1940 for the former decreased from 17.9 to 13.0 in 1950. The death rate among rural nonwhites decreased from 11.4 to 10.0 deaths per 1,000 population during the same period.

The trends in the death rates according to sex during the decade being considered were similar to those for the total population. In general, both males and females exhibited lower death rates in 1950 than they did in 1940. These were 12.2 and 10.5 for males and 9.5 and 7.6 for females in 1940 and 1950, respectively. This over-all reduction in the death rate characterized whites and nonwhites alike. The fundamental difference in trends in mortality by sex is that rural nonwhite men and women recorded a significant decrease in mortality experience, whereas rural white men and women experienced improvements of considerably less magnitude.

INFANT MORTALITY

One of the more sensitive indexes of the health status of a particular population is its infant mortality rate. The quality of care given to newly-born children as reflected in infant deaths is a good indicator of the general conditions of life prevailing within a society. In other words, a high infant mortality rate is usually indicative of a relatively low level of living, and a low infant mortality ordinarily signifies a relatively high level of living. In general, rural people in the United States have had infant mortality rates which compare favorably with those of urban peo-

ples, even though hospital facilities and medical personnel are concentrated disproportionately in the cities.

In 1949-1951 the infant mortality rate of the total population of the state was 34.7 infant deaths per 1,000 live births. This figure represents a notable decline in infant mortality since 1940. At that time, the infant mortality rate in Louisiana was 64.3, almost double the rate for 1949-1951. Racial differences in infant mortality are marked. Among Louisiana whites in 1949-1951, there were 25.3 infant deaths per 1,000 live births. A comparable figure for the nonwhite population was 48.5. Thus, in 1949-1951 the infant mortality rate of the nonwhites was almost twice as great as that of the whites. Nevertheless, the 1949-1951 rates reflect the significant improvements made by both races during the preceding decade. In 1940 the rate was 87.6 for nonwhites and 47.8 for whites. It is apparent that, relatively speaking, the differential in infant mortality favorable to the white population as compared to the nonwhite population remained in 1949-1951 essentially as it was in 1940.

A comparison of infant mortality rates in 1949-1951 by residence is presented in Table V. These data show that the total population of the urban parish (Orleans) was characterized by the lowest infant mortality rate (28.4). The totally rural and the semi-urban parishes ranked second, the composite rate in both amounting to 33.7. The semi-rural parishes made the poorest showing with 38.4 infant deaths per 1,000 live births. Thus, by 1949-1951, populations of the rural parishes apparently had lost much of their advantage of lower infant mortality to the residents of the more urban ones.

Relative to residence variations in infant mortality among the white population in 1949-1951, the semi-urban parishes reported the lowest rate (24.1). The totally urban parish (Orleans) ranked next with a rate of 24.9, the totally rural parishes ranked third (25.4), and the semi-rural parishes had the highest rate found among whites (26.5). The infant mortality rate for the state's total white population was 25.3.

Among the nonwhites, the most revealing observation from these data is the wide difference in infant mortality between the totally urban

TABLE V. — Infant Mortality Rates, Louisiana, 1949-1951, by Residence

	Infant Mortality Rates		
	Total	White	Nonwhite
<i>The State</i>	34.7	25.3	48.5
Totally rural parishes	33.7	25.4	46.7
Semi-rural parishes	38.4	26.5	54.7
Semi-urban parishes	33.7	24.1	50.8
Totally urban parish (Orleans)	28.4	24.9	33.5

Source: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949-1951.

parish and the other residential categories. Nonwhites living in Orleans Parish had a relatively low infant mortality rate compared to other nonwhites in the state, even though the figure was still higher than that for whites. In that parish in 1949-1951, non-whites had an infant mortality rate of 33.5. Comparable figures for the totally rural, semi-rural, and semi-urban parishes were 46.7, 54.7, and 50.8, respectively. Nonwhite residents of the semi-rural parishes thus had the highest rates among this race and, indeed, possessed the highest rate existing among any group in the state. Only in the totally urban parish (Orleans) was the infant mortality rate among nonwhites not greatly out of proportion relative to the corresponding rate among whites. However, even in this locality, the nonwhite rate was significantly higher than that for the whites, 33.5 as compared to 24.9, respectively. These data indicate that the Negro has been able to bring infant mortality under control to a much greater

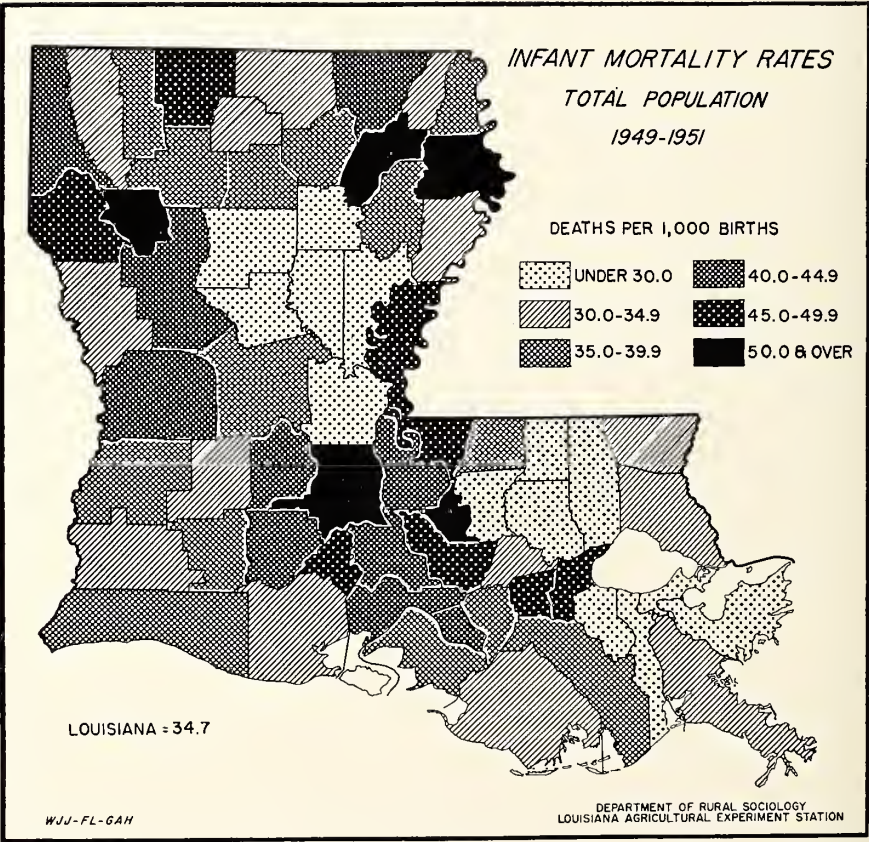


FIGURE 20. Infant Mortality Rates, Louisiana, 1949-1951, by Parish.

extent in the highly urban than in the rural and semi-urban parishes. This analysis of infant mortality rates by residence and race shows that the lower infant mortality of the total population of the exclusively urban parish (Orleans) was essentially a product of a low rate of infant deaths among nonwhites in the city of New Orleans.

In order to portray parish variations in infant mortality in 1949-1951, Figures 20, 21, and 22 have been prepared. (Appendix Table VI.) An examination of Figure 20 reveals that for the total populations, only one parish had an infant mortality rate of over 60 deaths per 1,000 live births, which approximated the national rate in 1940. Thus, Red River Parish, during 1949-1951, was the only one in the state having an infant mortality rate (70.3) for its total population which was above the national average of 1940. Several parishes had rates of 50 and over in 1949-1951. Among these were West Baton Rouge (52.7), St. Landry (51.9), Richland (51.1), and Madison (50.6) parishes. On the other

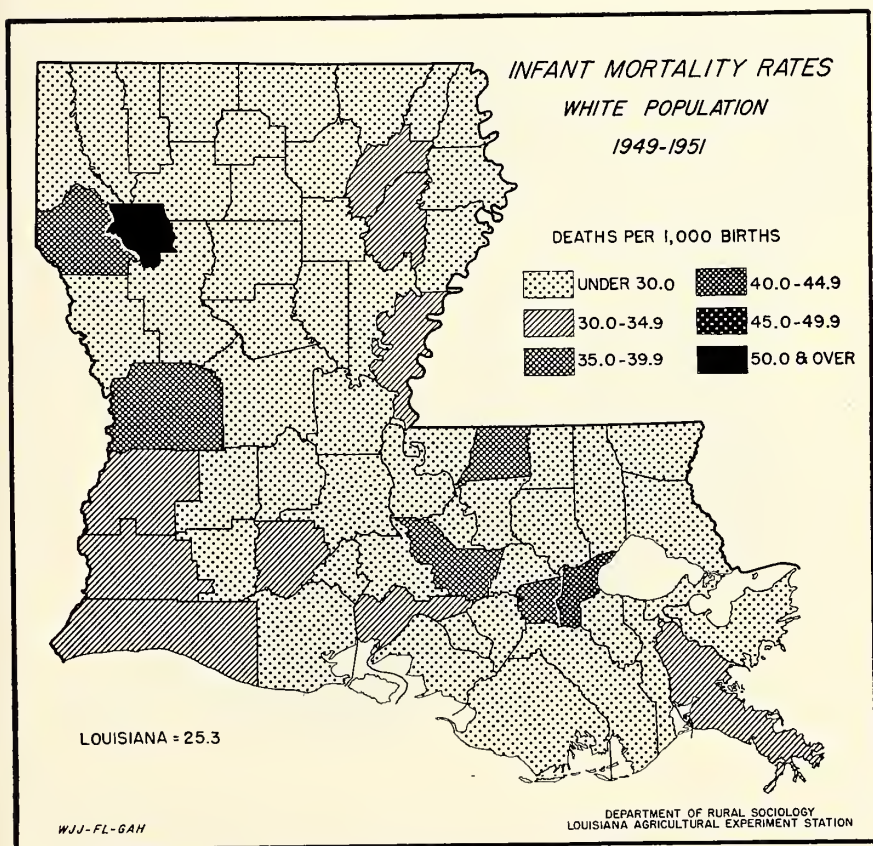


FIGURE 21. Infant Mortality Rates, White Population, Louisiana, 1949-1951, by Parish.

hand, fourteen parishes had infant mortality rates for 1949-1951 of less than 30. These were Avoyelles, Caldwell, Catahoula, East Baton Rouge, Grant, Jefferson, La Salle, Livingston, Orleans, St. Bernard, St. Charles, St. Helena, Tangipahoa, and Winn parishes.

When the infant mortality rates of the parishes are analyzed according to race, a somewhat different picture is obtained. In the first place, in all except two parishes, the white population had an infant mortality rate lower than that of the nonwhites. East Feliciana and Plaquemines parishes were the only ones to deviate from this pattern. In these cases, the differences in infant mortality between the two races were very slight. A comparison of Figure 21 with Figure 22 clearly demonstrates the higher infant mortality of the nonwhites in relation to the whites. Among the white populations of the various parishes, only one parish (Red River) had an infant mortality rate of 50 and above. A glance

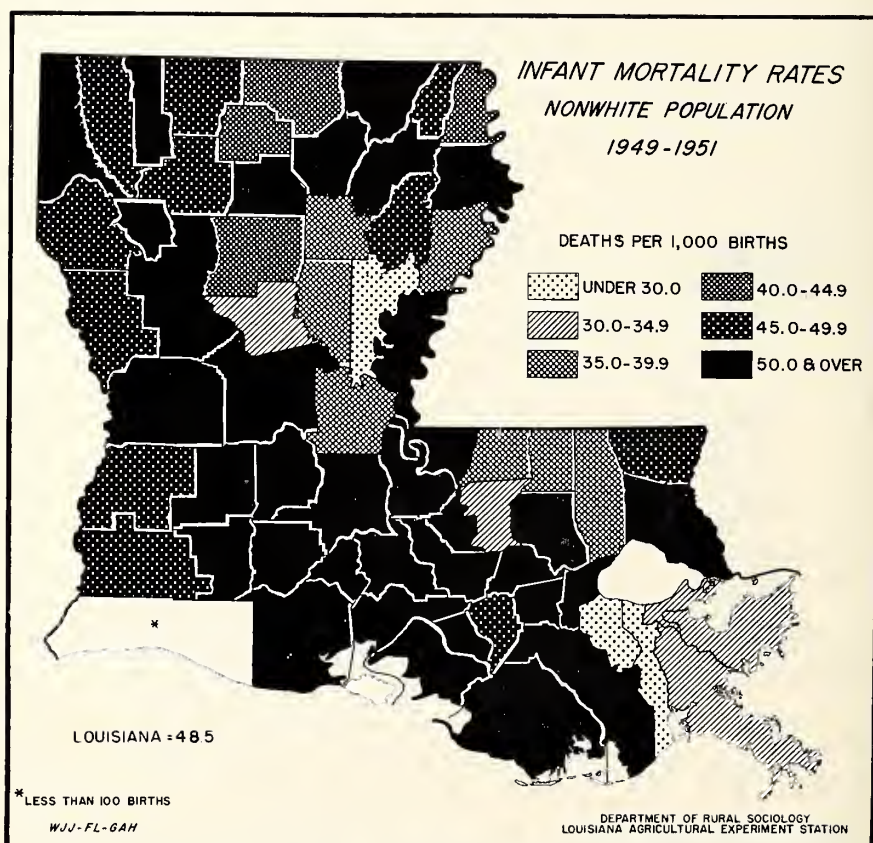


FIGURE 22. Infant Mortality Rates, Nonwhite Population, Louisiana, 1949-1951, by Parish.

at Figure 21 readily shows that the rate for the white population of a large majority of the parishes is under 30 per 1,000. In fact, this was the case in 48 of the 64 parishes in the state.

Among the nonwhite population, the majority of the parishes had infant mortality rates of 50 or above in 1949-1951. As a matter of fact, rates of such magnitude prevailed in 34 parishes. (See Figure 22.) In direct contrast to the situation among the whites, the nonwhite populations of only three parishes had fewer than 30 infant deaths for each 1,000 live births. These were Catahoula, St. Charles, and Jefferson parishes. Infant mortality rates among nonwhites ranged from a high of 85.1 in Red River Parish to a low of 27.0 in Catahoula Parish.

EXPECTATION OF LIFE

The use of the *life table* in the analysis of the mortality experience of a population has gained widespread acceptance during the last few decades. It provides a basis upon which comparisons may be made of the extent to which various peoples are winning the struggle against disease and early death. The life table shows the average number of future years of life that can be expected by a member of a particular population at any given age under the conditions of mortality prevailing within the society at a specified time. It is of interest to all people because it provides an estimation of the average number of years of life remaining to the individual at the various stages of life.

Life tables have not been differentiated by residence until recently. This was the case because the Bureau of Vital Statistics followed the practice of recording deaths according to their place of occurrence. Such a procedure introduced considerable error into the data because large numbers of persons died in hospitals in cities and towns away from their usual places of residence. Therefore, it has not been possible to make accurate comparisons of the expectation of life of rural and urban people except in a general manner. However, since 1937, deaths have been recorded on the basis of the actual residence of the deceased as well as according to the place of occurrence. This change has made it possible to calculate life tables differentiated by residence which provide further insight into the health status of rural people. Such tables are available for 1940, at present, only for the states of Ohio, Mississippi, and Georgia. This part of this analysis presents 1940-1941 life tables for the state of Louisiana. Tables for 1950 cannot be prepared until vital statistics, as well as other census data necessary for the computation, are available in detail for that period.

The life table for Louisiana in 1940-1941 (See Table VI) reveals that in all categories rural people had a greater expectation of life than did urban people. Rural white males at birth had a life expectation of 64.69 years as compared to 57.64 years for urban males in the same racial

classification. Corresponding figures for white females were 67.62 and 65.82 years. Similar differentials prevailed among the nonwhite population. Rural nonwhites had longer life expectancies than did urban nonwhites. Nonwhite males at birth in rural areas could expect an average life of 57.43 years as compared to 45.47 years for urban nonwhite males. Comparable figures for nonwhite females were 59.76 and 51.18 years, respectively. These data indicate that in 1940 the health status of rural Louisianians generally as reflected in life expectation was superior to that of the urban residents of the state.

The data presented in the life table indicate that both rural and urban people had longer life expectancies in the 1-4 year age group than they did at birth. This reflects the hazards of the first year of life as indicated by relatively high infant mortality rates. However, even after the first year of life, rural people in Louisiana continued to enjoy longer life expectancies than urban people.

Among both rural and urban residents, females had longer life expectations than did males. Specifically, in rural areas white females at birth could anticipate an average life of 67.62 years as compared to 64.69

**TABLE VI. — Expectation of Life, Louisiana, 1940-1941,
By Race, Sex, and Residence**

Age	Whites		Nonwhites	
	Males	Females	Males	Females
URBAN POPULATION				
Under 1	57.64	65.82	45.47	51.18
1- 4	60.04	68.47	51.61	56.34
5- 9	57.29	64.65	49.04	53.47
10-14	52.62	59.94	44.46	48.97
15-19	47.92	55.19	39.95	44.41
20-24	43.34	50.51	35.83	40.28
25-29	38.82	45.94	32.11	36.50
30-34	34.39	40.93	28.48	32.06
35-39	30.08	36.88	24.84	28.35
40-44	25.81	32.39	21.25	24.73
45-49	21.76	28.03	18.05	21.66
50-54	18.09	23.97	15.09	18.65
55-59	15.64	20.21	13.25	16.66
60-64	12.94	16.65	11.44	15.03
65-69	10.57	13.28	10.30	13.43
70-74	8.55	9.88	8.25	11.03
75-79	6.89	7.55	6.60	9.25
80-84	4.74	5.74	5.46	7.72
85-89	3.62	4.32	4.31	6.61
90-94	2.64	3.26	3.69	5.03
95 and over	—	—	—	—

(Continued)

**TABLE VI. — Expectation of Life, Louisiana, 1940-41,
By Race, Sex, and Residence
(Continued)**

Age	Whites		Nonwhites	
	Males	Females	Males	Females
RURAL POPULATION				
Under 1	64.69	67.62	57.43	59.76
1-4	67.06	69.11	61.83	63.01
5-9	63.82	65.17	58.73	59.97
10-14	59.18	60.40	54.10	55.27
15-19	54.39	55.56	49.51	50.55
20-24	49.83	50.80	45.15	46.21
25-29	45.47	46.15	41.16	42.18
30-34	41.02	41.56	37.15	36.11
35-39	36.48	36.96	33.20	34.25
40-44	32.12	32.43	29.43	30.48
45-49	27.85	28.02	25.62	26.90
50-54	23.79	23.68	22.20	23.51
55-59	19.97	19.51	19.06	20.59
60-64	16.55	15.51	16.19	17.83
65-69	13.32	11.89	13.73	15.15
70-74	10.49	8.47	10.95	12.34
75-79	8.09	5.78	8.43	10.27
80-84	6.15	4.51	6.56	8.46
85-89	4.54	2.81	5.15	6.45
90-94	3.45	1.92	3.81	2.44
95 and over	—	—	—	—

Source: Paul H. Price, Roland J. Pellegrin, Homer L. Hitt, *Differential Life Tables for Louisiana, 1940-1941*, Department of Rural Sociology and Institute of Population Research, Louisiana State University, Baton Rouge, Louisiana, October, 1953.

for males of the same age and race. Figures for nonwhites were 59.76 and 57.43 years, respectively. The same sex differential characterized the 1-4 year age group. In this age class, rural white females had life expectancies of 69.11 years as compared to 67.06 years for males in this residence and race category. For rural nonwhites, the corresponding figures were 63.01 and 61.83. Among urbanites of both races, females enjoyed similar advantages as compared with males in life expectation. The residence pattern is clear. Men and women of both races in rural areas had greater life expectancies at birth and in the 1-4 year age group than their counterparts in urban areas.

Racial differences in mortality, as reflected by the life table, are pronounced. In rural areas in 1940 white residents had a significantly longer life expectancy than nonwhites. Among males in rural areas, for example, whites at birth could anticipate an average of 64.69 years of

life as compared to only 57.43 years for nonwhites. Among females, the corresponding life expectancies were 67.62 years and 59.76 years. A similar racial differential also existed in the 1-4 year age group, which indicates that the superior mortality status of whites is not merely a manifestation of higher infant mortality among nonwhites during the first year of life. In fact, the differential prevails generally in all but the more advanced age groups. This greater life expectancy of whites as compared to nonwhites is also characteristic of the urban segment of the society.

CONCLUSIONS AND IMPLICATIONS

Several fundamental conclusions and implications regarding the health status of Louisianians at mid-century have emerged from this analysis of mortality. The systematic effort to refine comparisons in terms of residence, race, and age has made possible the isolation of clear-cut mortality differentials and patterns. The more important findings may be set forth as follows:

1. Rural people in Louisiana had a lower crude death rate in 1949-1951 than the urban population (7.9 as compared to 10.3). However, within the rural population, there was considerable variation in crude death rate among the parishes. The parishes with a high crude death rate are located principally in the general area of the Mississippi River. The process of standardizing the death rate for differential age structures of the various parish populations does not significantly alter the pattern of mortality. As was the case with the crude death rate, a high age-adjusted death rate among rural people is found in the parishes near and adjacent to the Mississippi River.

2. Although Louisiana's rural people continue to have lower mortality than her urban residents, there are indications that this residence differential is being narrowed rapidly. Most of the improvement in mortality realized in the state between 1940 and 1950 was due to the decline in the death rate among urban residents. Although the rural dwellers had a slightly lower mortality in 1950 than in 1940, the reduction did not compare in magnitude with that taking place within the urban population.

3. Irrespective of race and in both the rural and urban segments of Louisiana's population, females have a lower mortality experience than males. However, as to parish variations, the pattern of mortality is similar for the two sexes. Among both males and females, relatively high crude death rates prevail in the parishes in the general area of the Mississippi River. The pattern of mortality among rural males and females is generally similar to that of the total population, except that the rates are generally lower.

4. Nonwhite persons in both the rural and urban populations and

irrespective of sex are characterized by higher mortality than are white persons. The parishes with high crude death rates among nonwhites are concentrated in the vicinity of the Mississippi River, although several outside of this area also have high rates. However, the pattern of mortality among whites is markedly different from that among nonwhites. The high crude death rates prevailing in the total, rural, and nonwhite populations in the Mississippi River area do not obtain for the whites. In fact, whites in this section have relatively low crude death rates. This indicates that the high general mortality in this area is primarily the result of the concentration there of nonwhites.

5. The analysis of the variations in crude death rates and age-adjusted death rates by parish indicates that the most significant factor in determining the general pattern of mortality is the extent of concentration of nonwhites in the population. The age structure of some of the parishes is a factor of significance, but apparently it is much less decisive than racial composition.

6. The leading causes of death of Louisianians in 1949-1951, as in the nation as a whole, were diseases of the heart, cancer, and vascular lesions affecting the central nervous system, in this order. Among the white population of the state, violent or accidental death ranked third as a killer instead of vascular lesions affecting the central nervous system. Among nonwhites this latter cause ranked second as a grim reaper and cancer dropped to the third position. Transmissible diseases take a greater toll among nonwhites than among whites. There is considerable variation among the different parishes in the specific death rates due to diseases of the heart, cancer, and vascular lesions affecting the central nervous system.

7. A notable decline in infant mortality has been achieved in Louisiana since 1940. The rate for that year was almost double the 1949-1951 rate. Declines occurred in both the white and nonwhite populations. However, in 1949-1951, the infant mortality rate among nonwhites remained proportionately almost twice as great as among whites. The highest infant mortality rates for the total, the white, and the nonwhite populations prevailed in the semi-rural parishes. The lowest infant mortality rates for the total and nonwhite populations were found in the exclusively urban parish (Orleans), and the lowest infant mortality rate among whites was in the semi-urban parishes. There was considerable variation in infant mortality among the parishes.

8. Life tables for Louisiana differentiated by sex, race, and residence reveal that in 1940-1941 rural people had longer expectations of life than urban people. This was true irrespective of race and sex. Also among rural people, and urban as well, females had longer life expectations at birth than males; and whites had longer life expectations than nonwhites. In the advanced ages, however, the differential between whites and nonwhites did not obtain.

9. A comparison of the indexes of mortality for Louisianians derived from this study with corresponding measurements for the nation's population indicates the relative health status of the residents of the state. The over-all mortality experience of Louisianians compares favorably with that of the population of the United States. The crude death rate in the state was 9.1 in 1949-1951 as compared with the figure 9.6 in the nation as a whole in 1950. White persons in Louisiana had a considerably lower crude death rate in 1949-1951 than did whites in the population of the United States in 1950 (7.9 as compared to 9.5, respectively). However, nonwhites in the state had a higher crude death rate than their counterparts in the entire nation at this time (11.5 as compared to 10.9, respectively). There is evidence that the over-all lower mortality experience of residents of Louisiana as compared to that of the population of the United States results from an age structure in the former which is conducive to low death rates. In fact, when the death rates are adjusted for age structure, the relationship is actually reversed. The age-adjusted death rate for Louisiana in 1950 was 9.2, whereas the age-adjusted death rate for the population of the United States in 1950 was only 8.4.

10. One pressing health challenge for the immediate future pointed up by these findings is the urgent need for the more effective control of transmissible diseases among the nonwhite population of the state. The requisite knowledge and skill in the field of public health to achieve this better control are now available, and the task is largely one of bringing them to bear upon the existing problem situations. Another important challenge is also represented by the high toll of life among both races taken by the degenerative ailments, as diseases of the heart and cancer. Unfortunately, however, the advancement of our control over these killers is geared to research in the basic medical and other sciences and, thus, is not simply a matter of using knowledge already at hand.

APPENDIX

APPENDIX

**APPENDIX TABLE I. — Crude Death Rates, 1949-1951, Louisiana,
by Residence, Race, and Sex, for Parishes**

Parish	Crude Death Rates						
	Total Popu- lation	Rural	Urban	Whites	Non- whites	Female	Male
Acadia	8.3	7.2	9.7	7.5	12.1	6.8	9.9
Allen	7.5	6.8	9.1	6.4	10.8	5.9	9.0
Ascension	9.6	8.4	14.7	7.3	13.8	8.0	11.1
Assumption	9.8	9.8	*	8.0	12.3	8.8	10.8
Avoyelles	7.4	7.4	7.6	6.7	9.7	5.9	9.0
Beauregard	8.8	7.7	11.0	8.2	11.6	6.6	11.1
Bienville	8.5	8.5	*	8.0	8.9	7.0	10.0
Bossier	6.8	7.3	6.0	4.8	10.7	5.5	8.0
Caddo	9.1	7.5	9.8	7.2	12.3	7.8	10.6
Calcasieu	7.4	5.7	8.6	6.4	10.8	6.2	8.7
Caldwell	9.4	9.4	*	9.4	9.5	7.8	11.0
Cameron	5.9	5.9	*	5.5	10.3	4.1	7.6
Catahoula	7.9	7.9	*	6.4	10.6	7.0	8.6
Claiborne	7.4	7.6	6.5	6.9	7.9	6.1	8.7
Concordia	11.9	10.8	14.8	8.4	14.4	9.9	14.1
De Soto	10.5	10.2	11.7	10.0	10.8	8.7	12.4
E. Baton Rouge	6.9	7.2	6.7	5.3	10.0	5.9	7.8
E. Carroll	11.5	8.7	19.4	6.2	14.7	10.4	12.5
E. Feliciana	7.8	10.7	2.5	6.0	9.1	7.2	8.5
Evangeline	7.6	6.5	11.6	7.4	8.2	6.6	8.6
Franklin	8.1	7.4	12.9	6.5	10.9	6.8	9.4
Grant	9.2	9.2	*	8.7	10.4	7.6	10.8
Iberia	8.5	6.7	10.0	7.0	11.5	7.6	9.3
Iberville	12.0	11.0	15.5	8.9	15.2	10.7	13.3
Jackson	8.2	7.4	11.3	6.9	11.1	7.4	9.0
Jefferson	6.3	6.1	6.8	5.7	9.7	5.5	7.2
Jeff. Davis	7.6	7.8	7.4	7.1	9.3	6.4	8.9
Lafayette	7.7	7.5	7.8	6.3	11.3	6.5	8.8
Lafourche	7.4	6.8	10.3	6.5	13.0	6.6	8.2
La Salle	7.2	7.2	*	7.2	9.9	6.3	8.1
Lincoln	7.9	7.2	7.3	7.4	8.7	6.2	9.7
Livingston	6.7	6.7	*	6.1	10.1	5.0	8.3
Madison	11.5	8.9	14.8	6.5	14.1	10.4	12.7
Morehouse	9.3	9.7	8.5	7.0	11.7	8.2	10.4
Natchitoches	9.0	8.7	9.9	7.5	10.9	7.6	10.4

(Continued)

**APPENDIX TABLE I.—Crude Death Rates, 1949-1951, Louisiana,
by Residence, Race, and Sex, for Parishes**

(Continued)

Parish	Crude Death Rates						
	Total Popu- lation	Rural	Urban	Whites	Non- whites	Female	Male
Orleans	10.9	**	11.0	10.3	12.0	9.6	12.3
Ouachita	9.5	7.5	10.6	7.8	13.1	7.9	11.3
Plaquemines	7.0	7.0	*	6.6	7.6	6.5	7.5
Pointe Coupee	9.9	10.3	11.7	7.4	12.1	9.0	10.8
Rapides	8.9	7.4	10.6	7.5	11.8	7.4	10.5
Red River	9.2	9.2	*	7.9	10.4	8.0	10.4
Richland	9.3	9.2	14.8	6.8	13.0	7.8	10.8
Sabine	8.3	8.3	*	7.7	10.2	6.1	10.5
St. Bernard	7.8	7.8	*	6.9	11.1	6.2	9.3
St. Charles	7.7	7.7	*	5.7	11.9	6.1	9.3
St. Helena	6.1	6.1	*	5.2	7.1	5.2	7.0
St. James	10.3	10.3	*	8.5	12.1	9.3	11.3
St. John	9.9	9.9	*	8.3	11.5	8.2	11.6
St. Landry	8.0	7.0	10.7	6.5	9.9	6.7	9.3
St. Martin	7.4	7.0	9.5	6.3	9.5	6.6	8.4
St. Mary	9.8	11.0	8.7	7.6	13.4	8.6	11.1
St. Tammany	10.2	9.2	12.2	9.3	12.2	8.2	12.2
Tangipahoa	9.1	8.5	10.4	8.3	10.7	7.3	10.8
Tensas	10.7	10.7	*	6.0	13.3	9.9	11.5
Terrebonne	7.5	5.8	11.9	6.6	10.2	6.4	8.4
Union	8.4	8.4	*	8.0	8.9	7.2	9.5
Vermilion	7.3	6.5	8.6	6.9	10.2	5.5	9.0
Vernon	9.9	8.9	12.8	9.1	15.8	7.3	12.5
Washington	10.0	7.8	8.9	7.4	10.4	6.7	10.0
Webster	8.2	8.0	8.4	6.8	10.5	7.0	9.4
W. Baton Rouge	9.3	10.4	9.4	6.0	12.2	7.7	10.9
W. Carroll	7.3	7.3	*	6.2	12.2	6.2	8.4
W. Feliciana	8.4	8.4	*	6.1	9.3	9.3	7.9
Winn	7.7	6.6	9.6	6.8	10.2	7.2	8.2
Louisiana	9.1	7.9	10.3	7.9	11.5	7.7	10.5

Sources: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951.

United States Census of 1950 Population, "Louisiana, Characteristics of the Population," Vol. II.

* No urban population.

** No rural population.

**APPENDIX TABLE II. — Crude Death Rates, Louisiana, 1949-1951,
By Race and Residence, for Parishes**

Parish	Crude Death Rates			
	Rural		Urban	
	Whites	Nonwhites	Whites	Nonwhites
Acadia	6.7	9.8	8.3	13.4
Allen	6.0	9.7	7.6	12.5
Ascension	6.5	12.1	11.2	20.4
Assumption	8.0	12.3	*	*
Avoyelles	6.7	9.4	6.5	10.9
Beauregard	7.6	8.4	9.8	15.0
Bienville	8.0	8.9	*	*
Bossier	4.8	10.4	4.9	12.0
Caddo	6.1	9.0	7.5	14.2
Calcasieu	5.5	6.7	7.1	13.4
Caldwell	9.4	9.5	*	*
Cameron	5.5	6.9	*	*
Catahoula	6.4	10.6	*	*
Claiborne	7.7	7.5	5.6	8.1
Concordia	8.0	12.9	9.2	18.4
De Soto	10.3	10.2	9.4	15.1
East Baton Rouge ..	5.5	8.8	5.2	10.5
East Carroll	5.2	10.8	8.7	27.2
East Feliciana	10.9	10.7	2.4	3.1
Evangeline	6.3	7.2	11.1	14.2
Franklin	6.1	9.8	9.8	17.1
Grant	8.7	10.4	*	*
Iberia	5.8	8.3	7.9	15.5
Iberville	7.8	13.8	11.6	25.6
Jackson	6.3	10.0	9.1	17.5
Jefferson	5.6	9.7	6.0	9.6
Jefferson Davis	7.1	10.4	7.2	8.3
Lafayette	6.7	9.3	6.0	13.1
Lafourche	6.1	11.5	8.7	17.8
La Salle	6.9	9.8	*	*
Lincoln	8.6	7.9	5.9	10.2
Livingston	6.1	10.1	*	*
Madison	4.5	11.3	8.9	17.1
Morehouse	7.0	11.8	6.8	11.7
Natchitoches	7.5	10.0	7.4	13.8

(Continued)

**APPENDIX TABLE II. — Crude Death Rates, Louisiana, 1949-1951,
By Race and Residence, for Parishes**

(Continued)

Parish	Crude Death Rates			
	Rural		Urban	
	Whites	Nonwhites	Whites	Nonwhites
Orleans	**	**	10.3	10.6
Ouachita	5.5	14.3	9.3	12.7
Plaquemines	6.6	7.6	*	*
Pointe Coupee	7.8	12.2	5.3	11.7
Rapides	6.5	9.5	8.7	14.0
Red River	7.9	10.4	*	*
Richland	6.6	13.0	8.1	12.4
Sabine	7.7	10.2	*	*
St. Bernard	7.2	11.1	*	*
St. Charles	5.7	11.9	*	*
St. Helena	5.2	7.1	*	*
St. James	8.5	12.1	*	*
St. John	8.3	11.5	*	*
St. Landry	5.8	8.4	8.1	15.9
St. Martin	5.8	9.1	8.1	11.4
St. Mary	9.3	12.2	6.7	16.5
St. Tammany	8.2	11.6	11.7	13.9
Tangipahoa	7.9	9.8	9.1	13.0
Tensas	6.0	13.3	*	*
Terrebonne	4.7	8.7	10.9	17.3
Union	8.1	8.9	*	*
Vermilion	6.4	7.4	7.7	14.1
Vernon	8.5	16.4	11.8	14.7
Washington	7.2	9.3	7.6	11.8
Webster	6.3	11.1	7.8	9.6
West Baton Rouge	6.8	12.8	6.7	14.0
West Carroll	6.2	12.2	*	*
West Feliciana	6.1	9.3	*	*
Winn	6.3	7.6	7.6	13.1
Louisiana	6.6	10.2	9.1	13.0

Sources: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951.

United States Census of the 1950 Population, "Louisiana, Characteristic of the Population," Vol. II.

* No urban population.

** No rural population.

**APPENDIX TABLE III. — Crude Death Rates, Louisiana, 1949-1951,
By Sex and Residence, for Parishes**

Parish	Crude Death Rates			
	Rural		Urban	
	Males	Females	Males	Females
Acadia	8.4	5.8	11.6	7.8
Allen	8.5	5.0	10.3	8.0
Ascension	9.9	6.9	17.1	12.7
Assumption	10.8	8.8	*	*
Avoyelles	8.9	5.9	9.3	6.0
Beauregard	9.9	5.4	13.8	8.9
Bienville	10.0	7.0	*	*
Bossier	8.2	6.3	7.5	4.4
Caddo	8.8	6.3	11.3	8.4
Calcasieu	6.8	4.6	9.9	7.3
Caldwell	11.0	7.8	*	*
Cameron	7.6	4.1	*	*
Catahoula	8.6	7.0	*	*
Claiborne	8.9	6.3	8.4	4.9
Concordia	12.6	9.2	18.2	11.8
De Soto	12.1	8.4	13.5	10.3
E. Baton Rouge ...	7.6	6.9	7.9	5.6
East Carroll	9.5	8.0	22.4	16.9
East Feliciana	11.5	10.1	3.0	2.0
Evangeline	7.7	5.3	12.4	10.9
Franklin	8.5	6.4	16.5	9.7
Grant	10.8	7.6	*	*
Iberia	7.0	6.4	11.5	8.6
Iberville	12.4	9.7	16.9	14.2
Jackson	7.8	6.9	14.0	9.0
Jefferson	7.0	5.3	7.6	6.1
Jefferson Davis	8.4	7.1	9.5	5.7
Lafayette	9.1	5.9	8.7	6.9
Lafourche	7.6	5.9	11.2	9.5
La Salle	8.1	6.3	*	*
Lincoln	10.4	6.2	8.5	6.1
Livingston	8.3	5.0	*	*
Madison	9.3	8.2	16.9	13.0
Morehouse	10.4	9.1	10.4	6.8
Natchitoches	10.0	7.3	11.4	8.6

(Continued)

**APPENDIX TABLE III. — Crude Death Rates, Louisiana, 1949-1951,
By Sex and Residence, for Parishes**

(Continued)

Parish	Crude Death Rates			
	Rural		Urban	
	Males	Females	Males	Females
Orleans	**	**	12.3	9.6
Ouachita	8.9	6.0	12.7	8.8
Plaquemines	7.5	6.5	*	*
Pointe Coupee	11.3	9.2	7.7	7.9
Rapides	8.4	6.4	13.1	8.5
Red River	10.4	8.0	*	*
Richland	10.6	7.7	12.6	8.2
Sabine	10.5	6.1	*	*
St. Bernard	9.3	6.2	*	*
St. Charles	9.3	6.1	*	*
St. Helena	7.0	5.2	*	*
St. James	11.3	9.3	*	*
St. John	11.6	8.2	*	*
St. Landry	8.2	5.9	12.5	9.1
St. Martin	7.9	6.2	10.8	8.3
St. Mary	12.1	9.8	10.2	7.5
St. Tammany	11.1	7.2	14.7	10.1
Tangipahoa	10.4	6.5	11.9	9.0
Tensas	11.5	9.9	*	*
Terrebonne	6.5	5.1	14.3	9.7
Union	9.5	7.2	*	*
Vermilion	8.1	4.8	10.8	6.7
Vernon	11.4	6.4	16.2	9.8
Washington	9.3	6.4	10.9	7.1
Webster	8.9	7.1	10.3	6.8
W. Baton Rouge ..	11.9	8.9	8.0	6.9
West Carroll	8.4	6.2	*	*
West Feliciana	7.9	9.3	*	*
Winn	7.1	6.1	10.3	9.3
Louisiana	9.1	6.7	11.3	8.5

Sources: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951.

United States Census of the 1950 Population, "Louisiana, Characteristics of the Population," Vol. II.

* No urban population.

** No rural population.

APPENDIX TABLE IV. — Standardized Death Rates,* Louisiana, 1950,
By Race and Residence, for Parishes**

Parish	Total Population	White Population	Nonwhite Population	Urban Population	Rural Population
Acadia	9.2	8.3	13.3	10.0	8.4
Allen	7.7	6.5	10.6	8.8	7.3
Ascension	9.0	7.1	11.9	12.4	8.2
Assumption	9.0	7.3	11.8	*	9.0
Avoyelles	7.3	7.3	9.3	7.7	7.3
Beauregard	8.5	7.9	10.5	10.6	7.3
Bienville	7.5	6.2	9.4	*	7.5
Bossier	7.9	6.4	9.9	8.3	7.9
Caddo	9.0	7.1	11.9	9.8	7.6
Calcasieu	8.6	7.5	12.0	9.9	6.9
Caldwell	8.0	8.3	8.3	*	8.0
Cameron	6.2	5.9	9.2	*	6.2
Catahoula	7.4	6.7	8.6	*	7.4
Claiborne	6.8	5.8	8.0	5.9	7.1
Concordia	11.2	9.6	12.1	12.8	10.3
De Soto	8.8	7.7	9.8	10.2	8.5
East Baton Rouge	8.0	6.5	10.5	8.1	7.9
East Carroll	10.4	7.3	11.6	14.3	8.7
East Feliciana	5.9	3.9	8.0	1.6	9.3
Evangeline	8.9	8.2	11.1	13.9	7.6
Franklin	8.7	7.2	11.1	11.6	8.2
Grant	7.9	7.5	9.4	*	7.9
Iberia	9.0	7.4	11.8	10.2	7.8
Iberville	10.4	8.7	12.0	13.4	9.8
Jackson	8.3	6.7	12.5	10.5	7.3
Jefferson	7.6	7.0	11.0	7.8	7.6
Jefferson Davis	7.8	7.2	9.5	7.5	8.2
Lafayette	8.8	7.0	13.4	9.4	8.4
Lafourche	8.4	7.4	13.5	10.2	7.8
La Salle	7.1	7.2	8.4	*	7.1
Lincoln	7.8	6.8	9.7	7.8	6.9
Livingston	7.3	6.5	11.9	*	7.3
Madison	11.0	7.2	12.5	13.3	9.2
Morehouse	9.7	7.7	11.4	9.5	9.9
Natchitoches	8.4	7.1	9.9	9.4	8.1

(Continued)

APPENDIX TABLE IV. — Standardized Death Rates, Louisiana, 1950,
By Race and Residence, for Parishes**

(Continued)

Parish	Total Population	White Population	Nonwhite Population	Urban Population	Rural Population
Orleans	10.2	9.2	12.7	10.2	**
Ouachita	9.5	8.0	12.1	10.7	7.6
Plaquemines	7.8	7.5	8.7	*	7.8
Pointe Coupee	9.1	7.4	10.8	11.5	9.4
Rapides	8.6	7.4	11.0	10.7	7.0
Red River	8.1	7.0	9.4	*	8.1
Richland	9.8	7.6	12.6	12.2	10.0
Sabine	7.6	7.0	10.0	*	7.6
St. Bernard	9.0	8.2	10.8	*	9.0
St. Charles	7.8	6.6	9.8	*	7.8
St. Helena	6.2	4.6	7.8	*	6.2
St. James	9.2	7.7	10.8	*	9.2
St. John	9.5	8.2	11.3	*	9.5
St. Landry	9.4	7.5	11.7	11.3	8.6
St. Martin	8.0	6.7	10.6	9.3	7.9
St. Mary	9.5	7.8	11.9	9.0	10.2
St. Tammany	9.1	7.9	11.8	10.9	8.1
Tangipahoa	9.1	8.1	11.2	9.9	8.7
Tensas	9.2	6.4	10.5	*	9.2
Terrebonne	8.4	7.7	10.3	12.1	6.7
Union	7.9	7.0	9.5	*	7.9
Vermilion	7.5	7.0	10.5	8.7	6.9
Vernon	8.9	8.2	14.0	12.4	7.9
Washington	10.8	8.0	11.3	9.8	8.6
Webster	8.7	6.9	11.7	8.6	8.5
West Baton Rouge	8.7	6.4	10.4	10.2	9.5
West Carroll	7.7	6.9	10.5	*	7.7
West Feliciana	8.6	5.8	9.6	*	8.6
Winn	7.0	6.1	9.5	8.7	5.9
Louisiana	9.2	8.0	11.5	10.3	8.1

Sources: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951.

United States Census of the 1950 Population, "Louisiana, Characteristics of the Population," Vol. II.

* No urban population.

** No rural population.

*** Population of the United States in 1940 is used as a standard.

**APPENDIX TABLE V.—Death Rates Due to Diseases of the Heart,
Intra-Cranial Lesions of Vascular Origin, and Cancer, Louisiana,
1946-1948, for Parishes**

Parish	Death Rates per 10,000 Population		
	Diseases of the Heart (90-95) *	Intra-Cranial Lesions of Vascular Origin (83) *	Cancer (45-55) *
Acadia	22.9	6.2	9.4
Allen	25.0	6.0	10.3
Ascension	22.9	5.7	8.6
Assumption	32.3	6.8	11.9
Avoyelles	24.0	6.8	10.2
Beauregard	26.7	4.2	7.7
Bienville	17.5	8.8	8.8
Bossier	13.1	8.4	7.3
Caddo	22.8	7.8	10.5
Calcasieu	19.1	4.8	8.5
Caldwell	18.6	5.6	9.3
Cameron	16.9	7.7	3.1
Catahoula	20.6	14.2	7.1
Claiborne	20.0	5.3	7.9
Concordia	18.7	9.0	8.3
De Soto	27.2	11.2	11.2
East Baton Rouge	18.3	7.1	8.0
East Carroll	28.6	14.0	8.2
East Feliciana	104.9	9.1	11.7
Evangeline	16.8	5.4	7.9
Franklin	15.9	9.2	6.6
Grant	27.2	8.1	11.5
Iberia	23.4	7.1	9.7
Iberville	30.4	14.1	8.9
Jackson	24.8	8.1	11.8
Jefferson	17.1	3.3	7.0
Jefferson Davis	23.7	6.2	8.2
Lafayette	17.7	4.3	10.0
Lafourche	20.4	4.7	8.8
La Salle	29.6	5.8	11.5
Lincoln	20.6	7.1	8.7
Livingston	18.2	4.2	8.9
Madison	24.2	9.0	8.4
Morehouse	25.1	6.8	9.1
Natchitoches	23.5	6.5	8.8

(Continued)

**APPENDIX TABLE V.—Death Rates Due to Diseases of the Heart,
Intra-Cranial Lesions of Vascular Origin, and Cancer, Louisiana,
1946-1948, for Parishes**

(Continued)

Parish	Death Rates per 10,000 Population		
	Diseases of the Heart (90-95) *	Intra-Cranial Lesions of Vascular Origin (83) *	Cancer (45-55) *
Orleans	37.6	8.6	15.0
Ouachita	25.5	8.3	10.2
Plaquemines	18.3	5.9	8.1
Pointe Coupee	29.8	9.3	12.9
Rapides	29.0	8.9	9.2
Red River	9.8	12.1	9.8
Richland	22.7	9.9	9.9
Sabine	16.6	7.8	9.2
St. Bernard	24.1	5.0	8.0
St. Charles	20.8	6.2	9.2
St. Helena	17.5	4.4	3.3
St. James	31.2	8.9	8.9
St. John	23.6	8.1	10.1
St. Landry	19.0	6.4	7.7
St. Martin	20.4	3.4	7.6
St. Mary	22.9	8.4	11.0
St. Tammany	30.9	7.7	11.5
Tangipahoa	25.8	6.9	9.3
Tensas	37.2	10.7	10.7
Terrebonne	21.7	4.9	8.5
Union	17.8	8.7	8.1
Vermilion	15.6	5.4	9.4
Vernon	17.9	5.8	9.5
Washington	25.0	5.9	8.9
Webster	18.0	8.0	9.7
West Baton Rouge	24.4	13.9	9.6
West Carroll	18.1	4.5	6.8
West Feliciana	32.2	4.7	7.6
Winn	27.5	6.1	9.2
Louisiana	25.9	7.4	10.3

Source: *Vital Statistics of the United States*, 1946, 1947, 1948, Federal Security Agency, Public Health Service, National Office of Vital Statistics, Washington, D. C., Part II.

* Numbers under the causes of death are category numbers of the Fifth Revision of the International Lists, 1938.

**APPENDIX TABLE VI. — Infant Mortality Rates, Louisiana, 1949-1951,
By Race, for Parishes**

Parish	Infant Mortality Rates		
	Total Population	Whites	Nonwhites
Acadia	41.3	32.2	65.4
Allen	30.1	20.8	52.7
Ascension	34.0	16.9	60.0
Assumption	39.4	29.8	48.6
Avoyelles	27.3	23.0	34.9
Beauregard	37.7	34.7	48.6
Bienville	39.6	25.1	48.0
Bossier	30.1	20.4	47.1
Caddo	40.3	24.7	58.0
Calcasieu	34.1	30.0	45.7
Caldwell	25.3	18.6	39.8
Cameron	37.0	33.6	83.3
Catahoula	24.3	22.4	27.0
Claiborne	48.0	10.8	47.6
Concordia	46.0	31.9	55.6
De Soto	45.8	39.9	48.2
East Baton Rouge	25.3	20.6	33.6
East Carroll	36.1	23.7	42.4
East Feliciana	35.6	36.4	35.3
Evangeline	44.3	27.9	77.3
Franklin	38.6	30.4	47.6
Grant	23.9	20.2	31.3
Iberia	42.7	32.9	57.4
Iberville	47.7	37.5	55.9
Jackson	36.0	22.6	52.4
Jefferson	20.1	18.2	27.8
Jefferson Davis	35.4	29.7	51.1
Lafayette	46.2	29.9	73.9
Lafourche	35.4	29.5	63.9
La Salle	21.8	18.9	39.4
Lincoln	30.6	19.7	41.3
Livingston	23.4	16.5	54.1
Madison	50.6	18.3	62.0
Morehouse	42.1	27.0	54.4
Natchitoches	42.1	27.8	53.9

(Continued)

**APPENDIX TABLE VI. — Infant Mortality Rates, Louisiana, 1949-1951,
By Race, for Parishes**

(Continued)

Parish	Infant Mortality Rates		
	Total Population	Whites	Nonwhites
Orleans	28.5	24.9	33.5
Ouachita	39.1	25.8	58.7
Plaquemines	33.7	34.8	32.1
Pointe Coupee	43.5	12.8	63.3
Rapides	37.4	29.5	50.0
Red River	70.3	50.0	85.1
Richland	51.1	30.3	75.6
Sabine	31.7	25.3	47.4
St. Bernard	27.3	26.1	32.4
St. Charles	21.6	16.4	29.6
St. Helena	25.3	9.0	35.1
St. James	48.5	37.2	56.0
St. John	49.7	40.4	55.9
St. Landry	51.9	29.6	73.4
St. Martin	41.0	24.3	59.8
St. Mary	37.2	21.1	61.0
St. Tammany	30.6	17.0	50.0
Tangipahoa	29.3	23.1	37.3
Tensas	30.5	18.9	36.0
Terrebonne	32.5	25.7	52.7
Union	30.7	19.6	44.6
Vermilion	32.1	24.7	72.4
Vernon	40.7	39.2	50.0
Washington	34.6	24.2	49.6
Webster	38.6	25.4	57.1
West Baton Rouge	52.7	15.7	79.7
West Carroll	32.7	27.5	48.7
West Feliciana	49.0	19.0	53.8
Winn	24.6	15.8	40.6
Louisiana	34.7	25.3	48.5

Source: *Statistical Report of the Division of Public Health Statistics*, Louisiana State Department of Health, 1949, 1950, and 1951.

THE LEGUME MITE,
Petrobia (Tetranychina) apicalis (Banks),
**A Pest on Several Winter Growing
Legumes**

By

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The Legume Mite, *Petrobia* (*Tetranychina*) *apicalis* (Banks), a Pest on Several Winter Growing Legumes*

C. E. SMITH AND JAMES C. WEBER

INTRODUCTION

The legume mite, *Petrobia* (*Tetranychina*) *apicalis* Banks, is a serious pest on several species of clover, vetch and winter pea in Louisiana. The first complaint of injury to a crop was received from Tangipahoa and Washington parishes in the spring of 1948. Several dairymen complained that a red spider had damaged the clover in their pastures so severely that cattle would not eat it. It was found upon visiting the area that this mite was the species involved and had caused considerable damage. This spider mite had been observed infesting common vetch and white clover a number of years previously; however, it had been considered a pest of little importance.

Infestations increased in extent and severity during the 1948-49 season, and continued through the 1951-52 season. It caused relatively little damage during the 1952-53 season compared to that of the several previous seasons. It made a partial comeback during the 1953-54 season, though damaging infestations were not so widespread as they were during the seasons 1948-49 to 1951-52. Observations indicate that the severe drought was very probably largely responsible. One observation made during the fall of 1953 indicated that the severe drought was indirectly responsible for practically eliminating an infestation that was severe the spring before. Apparently the drought prevented any host plants from coming up until late in the fall, after or coinciding with conditions favorable for or required to break the diapause of the summer eggs;

* The red spider, or spider mite, with which this publication deals was first collected on white clover at St. Bernard, Louisiana, March 24, 1912, by T. H. Parks. This collection was used by Nathan Banks in describing the species which was given the name *Tetranychina apicalis* (Banks) and published in "Entomological News," Vol. 28, p. 195, 1917. It was re-described by E. A. McGregor in "The American Midland Naturalist," Vol. 44, No. 2, pp. 257-420, September, 1950. In "A Revision of the Spider Mite Family Tetranychidae" by Earl Pritchard and Edward W. Baker in press in "Pan American Entomologist" the genus is changed from *Tetranychina* to *Petrobia*. The only other published references to the species known to the authors are reports on the species entitled "A Potentially Serious Pest on Winter Legumes" by the senior author in 1948-49 Annual Report, and "Control of Spider Mite on Winter Legumes" by the authors in 1951-52 Annual Report of the Louisiana Agricultural Experiment Station.

The common name of "legume mite" is suggested for this species since it is a pest on several kinds of leguminous plants; this name further differentiates it from the clover mite *Bryobia praetiosa*, which attacks clover as well as a variety of unrelated plants including fruit trees.

consequently the summer eggs hatched and the young mites died for lack of a suitable host.

According to agronomists, averages of about 60°F. minimum and 85°F. maximum temperatures are required for the seed of the principal hosts—clovers, vetches and winter pea—to come up and the plants survive. Normally these conditions obtain during the first half of October in Louisiana. Since adequate moisture is required also, periods of dry weather during October and lasting into November, which was general over the state during 1952 and 1953, are disadvantageous to this spider mite.

The cause or causes for this mite's developing into a serious pest overnight, so to speak, are not known. However, it is a fact that it occurred simultaneously with the beginning of the use of organic insecticides on an extensive scale for the control of cotton insects and other pests. Other species of spider mites also increased in importance as plant pests at about the same time and this increase is believed to have resulted from the wholesale destruction of the natural enemies of the group.

In early May 1949 seed growers in Catahoula Parish reported a red spider was severely damaging, and in some instances killing, their winter peas. In a survey of the area it was found that the peas were heavily infested with this mite and considerable damage was being caused. The damage ranged from light injury to complete destruction of the plants. It is unlikely, however, that the spider mite was wholly responsible for the killing of the plants in those fields where the stands had been destroyed, because at the time, neighboring fields contained infestations of both this mite and the pea aphid, *Macrosiphum pisi* (Kltb.). It has since been observed that this mite is capable of killing host plants, but the process is slower than it is in cases where the pea aphid is a factor. Therefore, both pests very probably were involved.

In the above infestation one 50-acre field observed was a complete loss. The grower reported that in early March the plants were as healthy as any he had ever grown. The crop had been heavily infested with this mite as was evidenced by an abundance of summer eggs which had been deposited on weeds, bunch grass, fence posts and other objects of a permanent or semi-permanent nature within and bordering the field. This grower estimated that the loss to his winter pea crop in 1949, resulting from damage caused by this pest, or these pests, the spider mite and pea aphid, amounted to about \$15,000. Since that time, infestations have been general over the state, being especially severe during the springs of 1950, 1951 and 1952.

DISTRIBUTION

The legume mite is present throughout Louisiana and has been reported from Georgia, Florida, Missouri and Texas. It very probably is present over the entire Gulf States area where its host plants grow during the colder part of the year.

DESCRIPTION

Newly hatched young or larva has three pairs of legs and is bright red in color; this stage is followed successively by two nymphal stages and the adult. These last three stages have four pairs of legs, and are darker in color.

Female is considerably larger than the average of plant feeding species and is dark red in color; body is less than twice as long as broad, strongly convex above; legs are long and slender, the front and hind pairs being longer than the body; awkward and slow in movement, drops from host with slight disturbance, spins no web on hosts (Figure 1).



FIGURE 1.—Legume mite adult females on clover leaf—enlarged.

Male is much smaller than the female and is bright red in color; legs are proportionally longer, the forelegs being two and two-thirds as long as the body.

HOST PLANTS

The legume mite has been observed infesting the following plants: winter pea, *Lathyrus hirsutus* L. (also known as rough pea, Singletary

pea and caley pea); white clover, *Trifolium repens* L.; crimson clover, *T. incarnatum* L.; two species of hop clover, *T. procumbens* L. and *T. dubium* L.; Persian (reversed) clover, *T. resupinatum* L.; common vetch, *Vicia sativa* L.; hairy or winter vetch, *V. villosa* Roth. An unconfirmed report of this mite attacking bur clover, *Medicago* sp., was received. It has not been observed infesting any species of the genera *Melilotus* and *Pisum*. An attempt to establish an infestation on Austrian winter pea, *Pisum sativum* L., failed. It was not observed infesting red clover, though it very probably would; very few opportunities to observe it on red clover occurred because of the scarcity of the plant in Louisiana.

HOST PREFERENCES

The preference, or apparent preference, this spider mite has for its different hosts varied from time to time and/or under different conditions. On a whole its preference appeared to be in the following order: winter pea, white clover, hop clover, common vetch, crimson clover, Persian clover and hairy vetch.

On numerous occasions it was observed that feeding was confined entirely, or almost so, to a particular host in the presence of one or more other favored plants, whereas in other cases the feeding preference would be reversed. Why this switch in preference occurred was not determined. However, on a conjectural basis, it appears reasonable to assume that it might have been influenced by one or more of the following: The host being fed upon was the one that was available at the time the summer eggs hatched; consequently the mites had become accustomed to it or had cultivated a preferential taste for it over the others. Another possible influencing factor was the maturity of the plant—one being more desirable from the standpoint of succulence than the others.

An observation was made indicating a possible third factor. In this case, an infestation had changed from white clover to Persian clover. It was late in the spring, nearing the end of the active season of the mites, at which time they seek and collect around objects suitable for deposition of summer eggs. In this case, the Persian clover was much larger, growing in dense patches. The mites may have collected on these patches of Persian clover in the absence of more suitable objects for summer egg deposition. Hosts growing around objects on which summer eggs are deposited are usually blanched by the excess feeding of the mites.

NATURE AND EXTENT OF DAMAGE

Feeding is done predominantly on the top side of the leaves. It is accomplished by the mites puncturing the tissue with their mouth parts and extracting the plant juices. The punctures are made in irregular lines, which may crisscross covering the entire area of the leaf (Figure 2). The extraction of chlorophyll in feeding produces a characteristic blotching or stippling of the leaves, causing them to become grayish in color. Severely damaged plants may be killed by dessication following the injury.

Severely damaged plants produce few or no seed; consequently stands of these self-seeding plants may be almost or totally eliminated from an area—a pasture, etc.—by heavy infestations two or more successive years. Furthermore, heavy damage renders plants almost worthless as pasture crops—cattle refuse to feed on them except as a last resort.

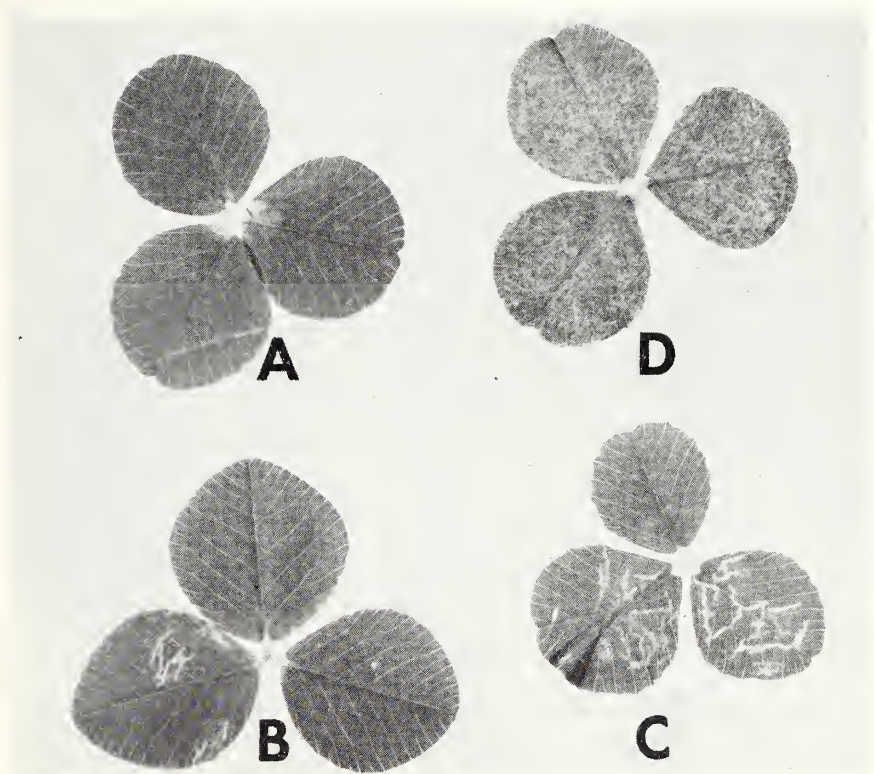


FIGURE 2—Clover leaves showing varying amounts of injury caused by the legume mite. *A*, no injury; *B*, and *C*, light injury showing pattern of feeding; *D*, severe injury.

This mite has a nuisance value also. Great numbers of them often enter buildings—residences, offices, factories, etc.—during the period of summer egg deposition, causing the occupants much concern. This occurs especially in buildings having lawns sodded to white clover.

LIFE HISTORY AND SEASONAL HABITS

The life history and seasonal habits of the legume mite are unique in several respects. First, two types or forms of eggs are produced; and secondly, it is active only about seven months of the year—from about November through May—the cold and cooler part of the year, being inactive as diapause eggs during the summer months. These periods



FIGURE 3.—Winter eggs of legume mite on clover leaf—enlarged.

vary from season to season, overlap and may include a month or more previous to and following those named. For differentiation purposes, the two kinds of eggs will be referred to as "winter eggs" and "summer eggs" indicating the period during which they prevail.

The winter egg is spherical, dark red to purple in color, and is deposited almost exclusively on the hosts—in the grooves and crevices of the main stem, and along the mid-ribs and veins on the underside of

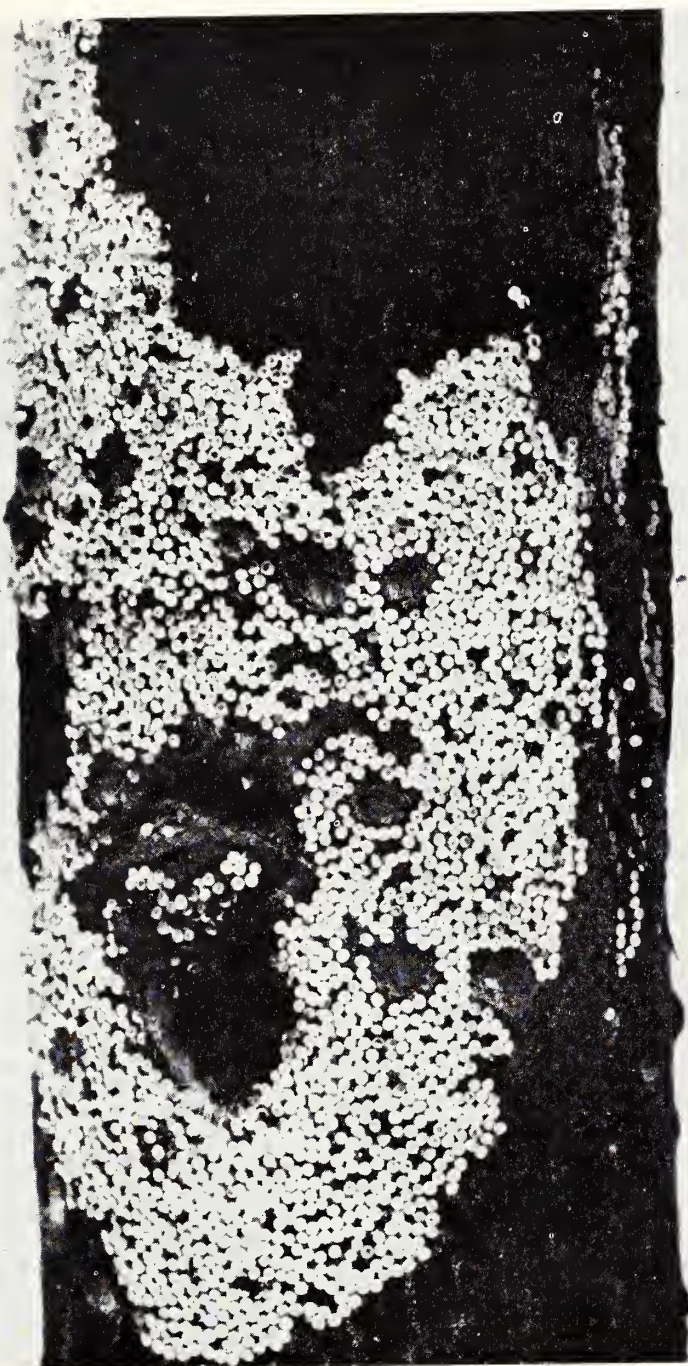


FIGURE 4.—Diapause summer eggs of legume mite—greatly enlarged.

the leaves. They hatch in two or more days after deposition, the number of days required depending on the temperature, etc. (Figure 3).

The summer egg is similar to the winter egg in size and color; however, it differs in that it is contained in a whitish-colored, cup-shaped receptacle. The receptacle is rigid and closed with a top or lid that has radiating grooves and ridges (Figure 4). These eggs are ovi-



FIGURE 5.—Pieces of weed and stems of bushes containing heavy deposits (the whitish areas) of the diapause summer eggs of the legume mite.

posited in great numbers, literally covering large areas and preferably are placed on rough surfaces—in cracks, under loose bark, splinters, etc.—on objects of a permanent and semi-permanent nature such as fences, especially the posts, trees, houses, bushes, weeds, bunch grasses and so forth which are on or near their breeding grounds (Figure 5).

In the laboratory, the life cycle of the legume mite from egg to egg ranged from 12 to 18 days. Two laboratory reared and mated females oviposited 86 and 143 eggs over periods of 6 and 10 days, respectively. Although the number of generations produced per season was not determined, it is self evident the number is sufficient to enable the species to build up huge populations during relatively short periods under favorable conditions.

With the above observations plus indications that objects with colors other than green were preferred for diapause egg deposition as background, a series of tests was conducted to determine if there were preferences between rough and smooth surfaces and different colors for the deposition of summer eggs. In these tests stakes one inch square by one foot long dressed on two sides, rough on two, and of five colors, plus a set of unpainted stakes to serve as a check, were exposed to ovipositing mites. The colors used were black, white, green, gray and red. Each was replicated four times, giving a total of 24 stakes.

The stakes were placed in a field of winter peas heavily infested with the legume mite and were left exposed from February 24 to April 6, 1950—a total of 41 days. At the end of this period, the stakes were examined for egg depositions. The sample consisted of three one-inch square areas taken at random on each side of each stake, making a total of 48 square inches per color and 144 square inches for each of the rough and smooth surfaces. The numbers of eggs counted in the three categories—color, rough and smooth surfaces—are given in Table 1.

As the data in Table 1 show, a high preference was shown for the rough surface over the smooth—93.5 per cent to 6.5 per cent. In the case of colors, green was the least attractive, followed by white and gray. Red, black and unpainted were preferred to a distinct degree in the order named.

During average seasons, the summer eggs begin hatching about the first week of November; however, under certain conditions, heavy hatching may occur or continue until about the middle of January or later. In the fall of 1950, heavy hatching was observed on November 2, and in 1951 on December 11. In each case, it was immediately following rains and a drop in temperature. One or both of these factors, following a rather extended rest period, appear to be necessary to break the diapause in the summer egg.

Likewise, the production of summer eggs appears to be influenced by certain factors and very probably by a combination of several. The indications are, however, that the physical condition of the host is an important factor and probably the most important one. Although the heavy production of summer eggs usually begins in late March and

TABLE 1.—Summary of eggs deposited by the legume mite on stakes with smooth and rough surfaces in 6 colors, Baton Rouge, La., 1950

Surface condition	Number of eggs deposited, by colors						Total
	Black	White	Green	Gray	Red	Unpainted	
Smooth edge	1,516	96	674	617	1,120	306	4,329
Rough edge	12,707	7,952	4,053	9,368	14,737	12,876	61,693
Totals	14,223	8,048	4,727	9,985	15,858	13,182	66,022
PERCENTAGES							
Smooth	10.6	1.1	14.2	6.1	7.1	2.3	6.5
Rough	89.3	98.8	85.7	93.8	92.9	97.6	93.5
Total	21.5	12.1	7.1	15.1	24.0	19.9	99.7

continues into May, in one instance observed, summer eggs were being oviposited in early February. In this case, it was on a pile of debris in the midst of severely damaged host plants, winter pea. Since the temperature was still relatively low and there had been plenty of rain, it appears that the devitalized condition of the host was probably the principal influencing factor. Later in the season, usually starting about mid-March after the hosts receive an appreciable amount of injury, heavy oviposition of summer eggs begins and continues until the last of the females die in late May or early June.

DISPERSION

Observations and trapping studies indicate that dispersion of the legume mite is accomplished by crawling, possibly by floating on the surface of water, especially following rains, and by air movement. Movement of the adults from plant to plant to desirable hosts in nearby fields and other locations, and to suitable objects for summer egg deposition, is accomplished largely by crawling on the soil surface, on interlacing branches of plants, fences and similar objects.

The dispersion of the larvae hatching from summer eggs is largely by air. After hatching, the young mites crawl upward on the objects on which the eggs were deposited, accumulating in great numbers, often several layers deep and covering the entire top of the object. From this vantage point they are picked up by the wind and scattered over adjoining areas—fields, etc. In one instance, they were observed leaving the tops of fence posts in great numbers, being so numerous on these particular posts that the tops of the posts appeared to be red in color, which was visible a distance of about 100 yards. While on top of these objects, the larvae spin webbing, which is doubtless used as transport vehicle.

During the winter and spring of 1950-51, a trapping experiment was conducted to ascertain if, and to what extent, this mite traveled through the air. The traps consisted of aluminum alloy plates five and one-half by eight inches bolted to wooden stakes for support. The effective trapping surface consisted of an area five by six inches covered with a thin layer of tree tanglefoot. The plates were bolted to the supporting stakes about five feet above the ground. A ring of tanglefoot was

TABLE 2.—Spider mites collected in trapping experiment conducted on the edges of a 5-acre pasture which contained a heavy infestation of the legume mite the previous spring, Baton Rouge, La., December, 1950-May, 1951

Period	Larvae of legume mite collected on 4 tanglefoot traps facing				All other mites, including advanced stages of legume mite, collected on the 4 tanglefoot traps facing				Total
	North	East	South	West	North	East	South	West	
Dec. 4-8, 1950.....	10	13	17	11	1	1	..	1	54
Dec. 8-15, 1950.....	51	12	11	5	6	1	..	..	86
Dec. 15-27, 1950.....	34	24	18	19	1	1	3	1	101
Dec. 27, 1950-Jan. 3, 1951.....	7	8	6	4	..	..	..	..	25
Jan. 3-8, 1951.....	18	16	17	8	..	..	..	..	59
Jan. 8-15, 1951.....	17	22	22	27	3	6	3	3	103
Jan. 15-22, 1951.....	27	22	32	25	10	5	13	8	142
Jan. 22-Feb. 5, 1951.....	59	45	40	47	16	12	12	16	247
Feb. 5-12, 1951.....	6	5	8	7	6	6	10	6	54
Feb. 12-19, 1951.....	11	10	6	12	4	2	2	1	48
Feb. 19-26, 1951.....	23	16	12	15	10	6	10	14	106
Feb. 26, Mar. 4, 1951.....	19	7	9	13	4	8	11	7	78
March 4-12, 1951.....	6	19	11	16	3	5	8	8	76
March 12-26, 1951.....	17	14	19	24	9	6	26	15	130
March 26-April 16, 1951.....	76	58	58	64	11	24	31	13	335
April 16-22, 1951.....	8	2	5	7	1	9	2	4	38
April 22-May 1, 1951.....	2	13	7	12	2	2	5	2	45
May 1-8, 1951.....	0	1	0	4	3	4	6	3	21
May 8-15, 1951.....	4	5	3	5	2	6	1	2	28
May 15-22, 1951.....	2	3	2	4	1	3	0	2	17
Total	397	315	303	329	93	107	143	106	1,793

placed on the stakes just beneath the plates to prevent mites from reaching them by crawling up the stakes.

A total of 16 plates was used, four on each side of a 5-acre test pasture in which winter pea was grown and which was heavily infested with this mite the previous spring. The tanglefoot-treated surfaces were placed facing the pasture area, so that four faced east, four south, four west and four north. The plates were examined at about weekly intervals, and the mites caught were recorded in two categories: (1) the larva of the legume mite, and (2) advanced stages of this species and all other species combined. The data obtained in this study are given in Table 2.

As the data show, considerable numbers of mites were collected on the traps, the larva of the legume mite being most abundant. They also show that there was little difference between the numbers collected on the plates facing the different directions. In another trapping experiment, one adult female was collected.

EXPERIMENTS IN CONTROL

The first attempt to control this spider mite was made in May 1949 near Jonesville, Catahoula Parish, in three single replicate tests conducted on winter pea. Sampling for evaluating the treatments presented a problem in the absence of any previous work on the species and the nature of growth of the host crop. In these tests the following methods were used: In test number 1, 10 slaps of tops of bunches of the host were made over petri dishes 100 mm in diameter in five locations in each plot—near each corner and the center—with the number of live mites collected recorded. In test number 2, the same method as in number 1 was used except a petri dish 8 inches in diameter was used; and in test number 3, five pieces of paper 6 inches square were placed under bunches of the host plant—one near each of the four corners and the center of the plot—in addition to the petri dish samples. The dusts were applied with rotary hand dusters at the rate of 20 to 30 pounds per acre.

In test number 1, the dusts were applied May 11, and the mite counts were made May 19—8 days after the application. The materials used and the number of live mites collected per treatment follow: sulphur, 0 mites; 1 per cent DN-sulphur dust, 0 mites; 1 per cent arathane* dust, 17 mites; 1 per cent parathion, 31 mites; and check, 51 mites.

In test number 2, the dusts were applied May 11, and the mite counts were made May 19—8 days after application. Results: sulphur dust, 21 live mites; 1 per cent parathion, 35 live mites; and check, 616 live mites.

In test number 3, the dusts were applied May 19, and observations

* Arathane, which was supplied by Rohm and Hass, has not been placed on the market.

on results were made 5 hours, 24 hours and 5 days after application. The materials used and results obtained are given in Table 3.

The data obtained in these tests gave several significant indications, namely; sulphur dust effectively controlled this spider mite under relatively high temperatures, though slower acting than the 1 per cent DN-sulphur mixture; and aramite and parathion at the strengths used were less effective. It was observed, however, that parathion completely controlled the pea aphid, which was of more benefit than was the control of the spider mite in this particular instance.

In 1950, three experiments—two in the laboratory and one in the field—were conducted to compare the effectiveness of several materials and combinations of materials. The materials used were dusting sulphur, DN, aramite and arathane.

In the laboratory tests, the mites were placed on white clover plants in flower pots and allowed to accustom themselves to the plants and start feeding before treatment. The dusts were applied in a standard laboratory dusting tower at the rate of 84 miligrams, equivalent to 10 pounds per acre. The numbers of dead mites were counted at intervals ranging from 1 to 72 hours after treatment. Test 1 was started February 13 and test 2 February 18.

The field experiment was conducted on winter pea growing broadcast on Sharkey clay soil, Mississippi Valley land, on L.S.U.'s Ben Hur plantation at Baton Rouge. There were nine treatments, including a check, which were replicated four times in randomized blocks. The plots were 40x53 feet, about 1/20 acre in area. The dusts were applied with rotary hand guns. The samples for mite survival evaluation con-

TABLE 3.—Comparison of treatments with five acaricides for the control of the legume mite, Jonesville, La., May, 1949

Acaricides	Live mites collected in petri dish at end of following periods after treatment			Mites collected on paper samples 24 hours after treatment			
	5 hours	24 hours	5 days	Alive ¹	Immobile ²	dead	% dead
Sulphur dust	201	179	3	352	110	31	6.3
1% DN-sulphur	17	59	4	60	35	316	76.9
1% arathane	14	180	45	165	60	306	57.6
1% aramite	94	511	67	262	28	36	11.0
1% parathion	248	103	6	141	4	19	11.6
Check	183	843	134	35	0	0	0.0

¹ Able to crawl.

² Unable to crawl.

sisted of four 6x6 inch areas of host plants—stems and foliage—per plot. Each sample was placed in a one-gallon ice cream carton with a 25 mm shell vial protruding from a hole in the top of the carton as a trap for collecting the mites.

Two applications of the dusts were made, February 27 and March 17; and four mite infestation counts, March 6 (2 replicates); 13, 20 and 28. In counts 1 and 2 only 20 per cent of the mites counted were listed.

The acaricidal materials and mixtures tested and results obtained

are given in Tables 4 and 5 (laboratory tests) and Table 6 (the field test).

As the data in Tables 4, 5 and 6 indicate, there was little difference among the treatments tested in the laboratory, with all being highly effective in 24 to 72 hours. Under field conditions, 1 per cent aramite-sulphur tended to be inferior to all of the other treatments, with 1 per cent arathane second least effective. There was a natural seasonal decrease in the population of this mite which accounts for some of the decrease in population toward the end of the test period.

Some of the difficulties and hazards involved in the control of this legume mite had become known by 1950. These included the following: The diapause eggs hatch over a considerable period some years, sometimes extending well into the winter; control should be effected during late winter or early spring, while the temperature is still relatively low, in order to avoid damage by the species. This precludes the use of sulphur, which acts slowly and only under relatively high temperatures and usually after much of the damage has been done. Also, the pea aphid is often a serious pest on some of the crops at the same time, making desirable a treatment that will control both species.

TABLE 4.—Comparative effectiveness and rapidity of kill of the legume mite in laboratory test No. 1, Baton Rouge, La., 1950

Acaricides	Number mites in test	Percentage of mites dead after application at end of						
		1 hr.	2 hrs.	3 hrs.	16 hrs.	24 hrs.	48 hrs.	72 hrs.
Sulphur	84	5	8	11	71	88	92	100
1% DN-sulphur....	85	12	18	20	59	67	72	100
1% DN-talc	83	29	29	40	53	58	72	100
Check	88	0	0	0	1	6	13	45

TABLE 5.—Comparison of effectiveness and rapidity of kill of the legume mite in laboratory test No. 2, Baton Rouge, La., 1950

Acaricides	Number mites in test	Percentage of mites dead at end of varying periods of time after application					
		2 hrs.	4 hrs.	7 hrs.	24 hrs.	48 hrs.	72 hrs.
Sulphur	31	29	29	55	90	100	..
1% DN-talc	29	31	31	76	86	90	100
1% aramite-talc	27	22	22	56	89	85	93
2% aramite-talc	32	22	22	41	41	78	94
Check	30	0	0	0	0	0	0

The above facts and conditions made necessary the finding of materials that were more effective than sulphur under adverse cool weather conditions for use in combating this mite. Since considerable acreages of some of the affected crops are grown for seed and not pastured, this permitted the possible use of materials that would leave hazardous residues. Consequently, all kinds of materials that had shown acaricidal value against other mite species, including several of the extremely toxic phosphates, some of which are systemic in action, were tested.

TABLE 6.—Effectiveness of various acaricidal dusts in controlling the legume mite on winter pea in a field experiment, Baton Rouge, La., 1950

Acaricides	Average acre rates, pounds	Average number mites in counts made				Average all counts	Per cent control
		After first application		After second application			
		7 days	15 days	4 days	11 days		
Sulphur	40	463	310	126	53	238	79
1% DN-sulphur.....	32	434	282	134	51	225	80
1% DN-talc.....	36	1,358	1,158	326	274	779	32
1% aramite-sul.....	38	473	570	275	78	349	69
1% aramite-talc.....	43	200	521	390	177	322	72
2% aramite-talc.....	35	1,238	310	181	73	451	60
1% arathane-talc.....	32	1,177	600	211	199	547	52
2% arathane-talc.....	23	588	592	157	58	349	70
Check		2,203	1,501	480	385	1,142	

The following materials were used and are listed by their common and chemical names:

Sulphur—Sulphur

DN—Dinitro-*o*-cyclohexylphenol

TEPP—Tetraethyl pyrophosphate

Parathion—O-O-diethyl-O-*p*-nitrophenyl thiophosphate

OMPA (Schradan, Pestox III)—Octamethyl pyrophosphoramide

R-242—Parachlorophenyl phenyl sulfone

Aramite—Chloroethyl butylphenoxy methyl ethyl sulphite

EPN—Ethyl *p*-nitrophenyl thionobenzenephosphate

Arathane—Dinitro capryl phenyl crotonate

Malathion—O, O-dimethyl dithiophosphate of diethyl mercaptosuccinate

Demeton (Systox)—O, *o*-diethyl-O-2—(ethylmercapto)—ethylthiophosphate

Metacide—Mixture of parathion and methyl parathion (20-80)

Ovotran—Parachlorophenyl parachlorobenzene sulfonate

During the 1950-51 season, four experiments were conducted, one on the destruction of summer eggs on fence posts and three on the control of the mite—one on old hay stacks and two in the field on winter pea. The fence post and hay stack tests were conducted on the Hope Plantation, Wisner, Franklin Parish, and one of the field tests was on the Experiment Station farm at Baton Rouge and the other at Foules, Catahoula Parish, on the farm of A. A. Thornhill.

The test on destruction of summer eggs on fence posts consisted of three treatments including a check, replicated three times, 10 creosoted posts constituting a plot or experimental unit. One series of plots was sprayed with tractor fuel and the other with an emulsion of tractor fuel, 1 to 2 parts of water. The applications were made November 1 with a compressed air sprayer, care being taken to wet the entire above-ground surface of the posts.

Evaluation of the treatments consisted of observations for the presence of young mites on the two center posts per plot at about weekly intervals until January 10, 1951. The observations revealed the follow-

ing: On November 7 and 14, young mites were numerous on the checks, but none were found on any of those that had been sprayed; no mites were found on either the sprayed or unsprayed in examinations made November 22, 26 and January 10, 1951.

The test on hay stacks consisted of seven, about 25x15x8 feet in size, with contents composed largely of old winter pea vines, weeds and other kinds of debris which were raked and stacked following the combining of the spring crop. Four of the stacks were treated with dusting sulphur, about 12 pounds per stack per application, with the remaining three serving as checks. The applications were made November 7 and 14. Observations on results were made at about weekly intervals until January 10, 1951, on thick stands of winter pea that were present on and immediately surrounding the stacks.

Observations indicated that the sulphur treatment was partially effective, but only for about a week following the applications. In the examinations made seven days following each application, the populations on and around the treated stacks were considerably less, averaging about one-half of those on and around the untreated stacks, and consisted entirely of first and second instar mites, whereas all stages were present on the checks. Two weeks following the second application, the population of mites was about the same on both treated and untreated stacks.

The two field experiments were conducted on winter pea on plots 50x50 feet replicated in four randomized blocks. The sprays were applied with a 50-gallon conventional type sprayer at about 400 pounds pressure. The applications were made March 15, April 2 and 18; and April 4 and 26 in the respective experiments.

For treatment evaluation, the number of mites surviving on 100 plant tips 3 to 4 inches long per treatment were counted. In the Baton Rouge experiment, the counts were made 2, 5 and 14 days after the first application; 4, 7 and 10 days after the second application; and 5 and 12 days after the third application.

In the Baton Rouge experiment, the materials and mixtures tested were: TEPP and sulphur alone and in combination, OMPA, parathion, R-242 and aramite. In the Foules experiment the four treatments that were showing best results in the Baton Rouge test were used, namely: OMPA, TEPP plus sulphur, R-242 and parathion.

Summaries of the results obtained in the two experiments are given in Tables 7 and 8.

As the data in Tables 7 and 8 show, all of the phosphorous compound treatments—OMPA, TEPP and parathion—and R-242 were moderately to highly effective in controlling this mite. A heavy rain which occurred just previous to the second count following the first application in the Baton Rouge experiment very probably tended to lower the population on all treatments and appeared to increase the effectiveness of OMPA, whereas the other treatments, with the possible exception of R-242, were rendered practically ineffective since a rapid buildup of

the populations followed immediately. The data also indicate that sulphur in combination with TEPP was more effective than either used alone, having both quick kill and residual values.

During the winter of 1951-52, a test consisting of one application of demeton was conducted on white clover and crimson clover on the farm of J. T. Cornley located about 6 miles east of Kentwood, Tangipahoa Parish. Three pints of 50 per cent demeton concentrate (24 ounces of the technical chemical) in 50 gallons of water were applied on 5 acres of clover—1 acre of white clover and 4 acres of crimson clover. Excellent commercial control was obtained, though not 100 per cent, under the prevailing winter-time conditions. One month after application, the plants in the treated areas showed very little fresh injury and were considerably larger than were the plants on the untreated areas. In the case of the white clover, there was a distinct difference in the stand. Some of the mites present on the treated areas were very probably from late hatching summer eggs from adjacent fence posts—extremely heavy hatching occurred about December 11, and subsequent hatching was observed January 8 and 18.

Two months after the application, arrangement was made with the owner to graze a young steer on the treated crimson clover. The steer showed no sign of ill effects after a week of grazing.

Also during the spring of 1952, two experiments were conducted on winter pea on the McHenry estate near Monroe, Louisiana. The materials in one experiment were used as sprays and applied with a low-gallonage cotton sprayer, and in the other one, dusts were used and applied with rotary hand dusters.

Materials Used: In the spray experiment, demeton, aramite, TEPP, metacide, EPN, malathion and ovotran were used; and in the dust experiment sulphur, 1 per cent DN-sulphur, 1 per cent aramite-sulphur, 1 per cent ovotran-sulphur and 1 per cent parathion were used.

Spray Experiment: This experiment consisted of eight treatments, including a check, which were replicated five times in randomized blocks. The plots were 42 feet by 294 feet, .28 acre in area. All materials except demeton were applied February 19, March 6, 13 and April 3; demeton was applied February 19 and April 3 only. For treatment evaluation, the number of mites surviving on 100 plant tips 3 to 4 inches long per treatment was determined as follows: between the first and second applications, February 20, 22, 25, 28 and March 3 and 5; between second and third applications, March 7, 8 and 11; between third and fourth applications, March 17, 19, 25 and 29; and after fourth application, April 5, 7 and 15.

Dust Experiment: This experiment consisted of six treatments, including a check, replicated four times in randomized blocks. The plots were 21 feet x 42 feet, or approximately 1/50 acre in area. The applications were made March 12, 19, 26, April 2, 9, 16 and 23. For treatment evaluation, the number of mites surviving on 100 plant tips 3 to 4 inches long was determined as follows: between first and second appli-

TABLE 7.—Effectiveness of seven acaricidal materials in controlling the legume mite on winter pea, L.S.U. Ben Hur farm, Baton Rouge, La., 1951

Materials	Amounts used in 50 gallons water	Mites per 100 plant tips after each application									Average all counts	Per cent control
		Days after 1st application		Days after 2nd application			Days after 3rd application					
		2	5	14	4	7	10	5	12			
OMPA	8 ounces	244	9	26	38	40	14	0	4	47	97	
TEPP, 40%	2½ ounces	93	416	1,552	268	287	250	381	352	450	77	
TEPP-w.* sulphur	2½ ozs-5 lbs.	162	116	1,032	215	224	168	72	209	275	86	
Parathion--												
15% w. powder	1 pound	149	51	550	210	19	27	5	46	132	93	
R-242	2 quarts	132	394	492	103	97	79	62	266	203	90	
Aramite,												
15% w. powder	1 pound	836	771	1,524	1,318	696	325	396	120	748	63	
Sulphur dust	2 lbs./plot	1,174	951	2,422	1,513	1,015	592	405	53	1,016	50	
Check		2,513	2,109	3,082	2,999	2,048	1,323	1,367	726	2,021		

* w—wetttable.

TABLE 8.—Effectiveness of four acaricides in controlling the legume mite on winter pea, farm of A. A. Thornhill, Foulles, La., 1951

Materials	Amounts used in 50 gallons water	Average number mites per 100 plant tips following the applications						Average all counts	Per cent control
		After first application			After second application				
		7 days	14 days	21 days	2 days	7 days			
OMPA + Triton 1956 ¹	1 pint.....	23	4	2	0	0	6	99	
TEPP, 40%	2½ ounce-								
w-sul.	5 pounds.....	227	230	56	4	47	113	93	
R-242	2 quarts.....	228	135	36	7	7	83	95	
Parathion, 15% w.p.	1 pound								
Triton 1956	2 ounces.....	51	7	10	0	0	14	99	
Check		802	3,118	1,513	1,754	820	1,601		

¹ Triton 1956—Phthaic glycerol alkylid resin.

cations, March 13, 14 and 18; between second and third, March 20, 22 and 26; between third and fourth, March 27, April 2; between fourth and fifth, April 3 and 9; between fifth and sixth, April 10 and 14; between sixth and seventh, April 17 and 21; and after seventh, April 24.

Summaries of the results obtained are given in Tables 9 and 10.

As the data in the tables show, all of the sprays were highly effective in controlling the legume mite, whereas only the one per cent parathion dust, among the several dusts compared, can be classed as highly effective. However, the one per cent DN-sulphur and one per cent ovotran-sulphur dusts gave satisfactory control. Both of the latter dusts are considered relatively harmless from a residue standpoint, and therefore might be used safely on crops being pastured. The ovotran spray at the relatively high rate of 2 pounds per acre per application was highly effective, indicating that possibly the difference in the effectiveness of this material used as a spray compared with its use as a dust was probably due to difference in the amounts of technical chemical used rather than the method of application.

No control experiments were conducted during the 1952-53 season because of unsuitable infestations resulting from conditions discussed elsewhere in this publication. During the 1953-54 season, the species was again somewhat late developing damaging infestations, which again probably was the result of unfavorable climatic conditions that existed during the fall of 1953. However, with the relatively mild temperatures during the winter and early spring severe infestations developed during March, especially during the latter part of the month.

The control studies made during the spring of 1954 consisted of the use, on a practical basis, of malathion in two instances and aramite in one. In one case, malathion was applied on white clover in a yard about one acre in size. The clover was heavily infested and the mites had been entering the residence in large numbers for a week or more. One and one-third pints of 5-pounds-per-gallon malathion concentrate in 30 gallons of water was applied to the clover for a radius of about 50 to 60 feet around the house. The application was made between 10 and 11 a.m., April 2, 1954.

The results were checked 24 hours later with the following findings: Not a single live mite was found on the sprayed area. Neither was any seen in the house after about 6 hours after application, after the owners returned from work. An average of over 3 live mites per clover leaf was still present on the unsprayed part of the lawn. The lawn was inspected again one week later and no mites could be found on either the sprayed or unsprayed portions.

The second test consisted of the treatment of a mixed white and crimson clover pasture consisting of about 20 acres owned by Gabriel Daigle near Church Point, St. Landry Parish. About 2 acres were treated with malathion at the rate of $\frac{2}{3}$ pint of a 5-pounds-per-gallon concentrate per acre. The remainder of the field, about 18 acres, was sprayed with aramite. Five gallons of 2.6-pounds-per-gallon concentrate were

TABLE 9.—Effectiveness of seven acaricidal sprays in controlling the legume mite on winter pea, McHenry Estate, Monroe, La., 1952

Materials	Acre rates	Average number of mites surviving per 100 plant tips between applications during treatment period					Average all counts	Per cent control
		Between 1st and 2nd	Between 2nd and 3rd	Between 3rd and 4th	After 4th			
Demeton	0.5 pound.....	33	7	116	18	44	95	
Aramite	0.5 pound.....	79	34	151	156	105	88	
TEPP	0.25 pound.....	81	52	160	91	96	89	
Metacide	1 pint.....	33	15	41	28	29	97	
EPN	0.6 pound.....	68	29	43	35	44	95	
Malathion	0.5 pound.....	90	54	135	58	84	90	
Ovotran	2 pounds.....	95	19	15	8	34	96	
Check		540	612	1,282	1,023	864		

TABLE 10.—Effectiveness of five acaricidal dusts in controlling the legume mite on winter pea, McHenry Estate, Monroe, La., 1952

Materials	Average acre rate Pound i	Average number mites per 100 plant tips during treatment period and per cent survival and control										Average all counts	Per cent control
		Between 1st and 2nd	Between 2nd and 3rd	Between 3rd and 4th	Between 4th and 5th	Between 5th and 6th	Between 6th and 7th	After 7th					
Sulphur.....	35.9	1,049	1,004	1,143	447	167	109	248	600	52			
1% DN-sulphur.....	14.6	539	466	590	267	99	43	161	309	75			
1% aramite.....													
sulphur.....	12.1	483	775	986	496	189	262	344	505	60			
1% ovotran.....													
sulphur.....	11.7	905	427	339	133	37	43	201	298	76			
1% parathion.....	12.3	195	116	58	12	6	5	46	63	95			
Check.....		1,592	1,713	2,170	1,189	749	578	774	1,252				

used on the 18 acres. The sprays were applied with a low-gallonage cotton sprayer equipped with 3 nozzles per row at the rate of 8 gallons per acre. The applications were made April 2.

The results were observed on April 5 and 12—3 and 10 days after application. Five 100-leaf samples of white clover were taken from five different locations on each treatment on April 5 and were examined in the laboratory April 6. A total of 4 live adult mites and about 80 newly hatched larvae were found on the 5 samples from the malathion treated plants; and on the 5 aramite treated samples, there were 130 adult mites still showing life but nearly dead, and about 200 newly hatched larvae.

The grower turned his cattle into the field after the above mentioned samples were taken.

One week later the field was again visited and conditions noted. There were still very few mites on the malathion treated area, whereas the population appeared to be rebuilding slightly on the aramite treated portion. It was noted also that the cattle appeared to have grazed much more heavily on the malathion treated area than on the aramite treated area. After the above observation was made the grower was requested to note and make observations on any apparent preferences between the treated areas. (The grower had no knowledge of the senior author's observation.) He sent word that he had noticed that the cattle stayed on the malathion treated area most of the time and had grazed it closer than they had the other part. It so happened that the gap through which the cattle entered the field was on the opposite side from the malathion treated area, thus forcing them to cross the aramite treated part of the field to reach the malathion treated part.

SUGGESTED CONTROL MEASURES

For Destruction of Dormant Summer Eggs

During the summer, large numbers of the dormant summer egg can be destroyed (1) by spraying fence posts and other objects of a permanent nature located on or near areas that were heavily infested and on which summer eggs were deposited, with fuel oil or some other light oil such as kerosene; (2) by cutting with mowing machine or other ways and burning all weeds, bunch grass, bushes and the like that grew among or near heavily infested crops the previous spring. Where the growth is sufficiently dense, it is best to let the cut material dry thoroughly and then burn broadcast; otherwise the cut material should be raked into windrows and burned. These operations can be done anytime after summer egg laying is completed about June 1 and before the time they start hatching about November 1.

For Control of the Legume Mite on Plants

This mite can be controlled effectively by the proper use of several chemicals. The chemical that should be selected depends on several factors, especially the time of the year—whether or not it is during the

colder or warmer part of the mite's active season—and whether or not the crop to be treated is being grazed by livestock. The treatment should be started as soon as the plants become infested and injury starts showing. This may occur anytime from November to February. Normally treatment for control of incipient damaging infestations should be started in December or January. Several of the more promising chemicals tested, with suggestions on their use in combating this spider mite, follow.

Malathion used at the rate of $\frac{1}{2}$ pound of the technical chemical ($\frac{2}{3}$ pint of a concentrate containing 5 pounds of technical chemical per gallon, or $12\frac{1}{2}$ pounds of 4 per cent dust) per acre per application has given excellent control of this mite. It is relatively safe to use and is effective under varying temperatures. On pastures and grazing lots, livestock should be kept off about one week after an application.

Demeton (Systox) and OMPA (Pestox) used at the rate of $\frac{1}{4}$ pound of the technical chemical (1 pint of 2 pounds of technical chemical per gallon concentrate) per acre per application are especially effective in controlling this mite. Both compounds are more effective when applied at fairly high gallonage rates—6 or more gallons per acre—or on plants wet with dew or rain. They are systemic in action, remaining effective for three to four weeks after application. Because of this, livestock should not be allowed to graze on treated plants until about four weeks after an application.

Parathion is fairly effective against this mite when used as a one per cent dust at the rate of 15 to 20 pounds per acre per application. Several applications a week or ten days apart may be required to bring an infestation under control. Livestock should not be allowed to graze on treated plants for at least two weeks after the last application.

TEPP at the rate of 1 pint of 50 per cent concentrate will kill the active mites it actually contacts—but the quiescent forms and eggs are affected little or none. Also it is more effective when applied on dry plants. Best results are obtained if the application is made under conditions favorable for the mites to be active and feeding. This compound loses its toxicity soon after being mixed with water. Therefore solutions should be applied as quickly as possible after mixing and never allowed to stand in the sprayer overnight. Because of this, it is useful in knocking down threatening infestations that develop on pastures which cannot be vacated for as long as a week. Livestock should not be allowed to graze on the plants until two nights have lapsed after an application of **TEPP**.

All of the above compounds are organic phosphates and with the exception of malathion are extremely toxic to mammals, including man. Therefore, the greatest of care should be exercised in handling and applying them, and all the precautionary measures given on the containers should be followed.

Aramite at the rate of $\frac{1}{2}$ pound of the technical chemical per acre per application has given satisfactory results. It is considered to be non-

toxic, or nearly so, to mammals. Therefore, it can be used on pastures and grazing lots inhabited by livestock.

Sulphur dust and 1 per cent DN-sulphur dust are effective after the weather warms up. The 1 per cent DN-sulphur dust is quicker in killing and will kill under somewhat lower temperatures. They are relatively slow acting; consequently several days of favorable weather are required for satisfactory results. They are non-toxic, and therefore can be used on pastures and grazing lots in use.

SUMMARY

The legume mite, *Petrobia (Tetranychina) apicalis* (Banks), is a serious pest of several species of clover, vetches and winter pea. It infests these crops from about November through May, passing the summer as a dormant egg. There are two kinds or types of eggs. One is spherical in shape, dark red in color, and is oviposited mostly on host plants and hatches in a few days after being laid. The dormant or diapause egg is similar to the winter egg in shape, color, etc., but is oviposited in or protected by a whitish-colored, rigid, cup-shaped receptacle with a lid. These eggs will not hatch until they have passed through the summer rest period and conditions have become favorable the following fall. From 12 to 18 days are required for a complete life cycle.

A number of chemicals tested controlled the legume mite. Sulphur and 1 per cent DN-sulphur dusts are effective under relatively high temperatures—70°F. or above. Several of the phosphates are especially effective. These include demeton, OMPA, malathion and parathion. TEPP will kill the active stages contacted by sprays, but has little or no effect on the eggs and quiescent forms. Aramite, EPN and ovotran were also effective against the species. Suggested control measures are given.

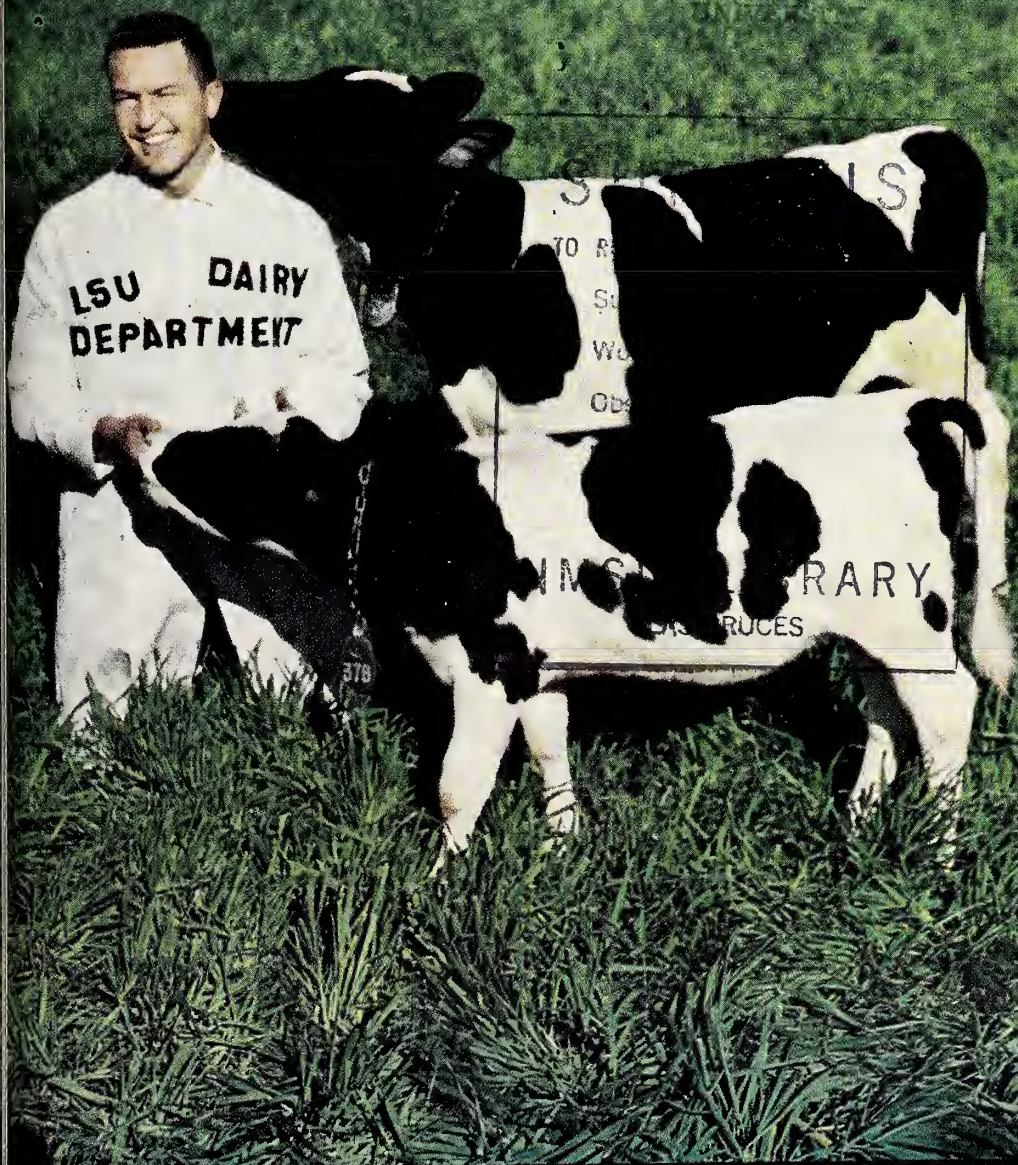


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DAIRY CALF RESEARCH

In Louisiana

By L. L. Rusoff and J. B. Frye, Jr.



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RECOMMENDATIONS*

1. Calves raised for replacements should be sired by good bulls.
2. Calves should be allowed colostrum for the first 3 days of life.
3. They should be raised in individual pens which should be kept clean and dry.
4. Warm whole milk (100°F) at not more than 10 per cent of the body weight should be fed for at least 2-4 weeks; skimmilk may be fed after 2 weeks for a period of 4 - 6 weeks.
5. Several management practices and nutritional regimes may be followed depending upon the amount of whole milk available.
6. A good calf starter and good quality hay can be fed starting at 7 days of age.
7. Carotene or vitamin A supplement must be added to the starter when whole milk feeding is discontinued.
8. 1 per cent common salt, 1 per cent oyster shell and 1 per cent defluorinated phosphate or 1 per cent common salt and 2 per cent steamed bonemeal or di-calcium phosphate in the calf starter will supply the necessary minerals.
9. The antibiotic aureomycin (Aurofac A) should be included in the calf starter at the 1 per cent level.
10. Calves can be grouped after 4 months of age.
11. Calves may be placed on pasture at 8-10 months of age; grain, silage and hay should be fed, depending upon the quality and amount of pasture available.

* For specific information on any points listed above or not included in this publication, write to the Dairy Department.

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Dairy Calf Research in Louisiana

L. L. Rusoff and J. B. Frye, Jr.*

I. INTRODUCTION

Providing replacements for the dairy herd has become of increasing importance during the past few years. With the rapid growth and expansion of the dairy industry in the South it has been necessary in many cases for the dairyman or for those who want to establish a dairy to purchase animals from the Midwest. Many farmers have hesitated to go into the dairy business because animals could not be found within a reasonable distance and at a reasonable price.

Improvement in the inherent producing ability of a dairy herd is accomplished either through purchased replacements or through calves that are raised. In order to maintain a herd, approximately 20 per cent to 30 per cent of the milking herd must be replaced each year. This means that in order to maintain the present population of 326,000 dairy cattle in Louisiana approximately 65,000 to 98,000 dairy heifers must come into production each year. Raising replacements has assumed added significance during the past few years as the result of using good dairy sires and the artificial breeding program. Artificial breeding has made it possible for the farmer to breed his cows, at a very reasonable price, to the best bulls that money can buy. The advantages of raising replacements as compared to buying them are as follows: (1) *Less expensive*. Good cows are expensive and hard to find. (2) *Minimizes incidence of disease*. Once a herd has been established as a clean herd it is unwise to run the risk of infecting a herd by introducing animals from the outside. (3) *Genetical improvement factor*. The breeding value of purchased animals is often unknown. The most certain way to improve the producing ability of a dairy herd is to breed the cows to sires of known high-transmitting ability and to grow the calves and heifers for optimum size. One may use the best of these heifers as replacements for the lower producing cows that are culled or sold each year. (4) *Better acclimated to local conditions*. Although the importance of this factor is not fully established, it seems that animals brought in from different regions may not be very efficient as breeders or milk producers until a period of time has elapsed in which they would have an opportunity to become adjusted to local management practices and the environment.

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The cost of raising a heifer until she is in production is just as high for one carrying poor inheritance as for one carrying good inheritance. Consequently, it is uneconomical to spend time and money raising a calf that, because of the undesirable characteristics of its parents, is not likely to be a profitable cow. The first consideration in raising calves for replacements is to select only calves sired by good bulls and out of good cow families. The improvement of dairy herds depends upon raising healthy, well-grown calves from parents with the ability to transmit high production and desirable characteristics.

With these points in mind, investigations have been initiated to develop better and more efficient systems of raising dairy herd replacements. Management studies and nutritional research on the economical systems of raising dairy calves are reported herein.

II. CALVING TIME

A cow that has been properly cared for during the dry period of 6 to 10 weeks should have little difficulty at calving time and should be in excellent physical condition for maximum performance during her lactation period. A cow approaching the time of parturition should be separated from the rest of the dry herd. If at all possible, she should be placed in a roomy, well-bedded box stall that has been thoroughly cleaned and disinfected. However, if this is not possible, a small clean pasture close to the barn may be used as a last resort.

Calving time is a critical period for the cow and calf. Although the cow should not be disturbed, she should be observed from time to time and assistance should be given if necessary. Immediately after the calf is born membranes or mucus should be removed from its mouth and nostrils. Artificial respiration is sometimes necessary to start its breathing. If the cow is not able to take care of her calf it should be rubbed dry with burlap. This is especially important if the air is damp and cold. To avoid navel infection, the navel cord should be clipped off about two or three inches from the body and disinfected with tincture of iodine. By following this practice at Louisiana State University, navel infections have been almost completely controlled. The cow's udder should be washed with warm, soapy water, and weak calves should be given assistance in acquiring their first feeding of milk or colostrum. The calf should start nursing within one hour after birth.

III. CALF QUARTERS

After 24 hours of age the calf is separated from her dam and placed in a clean, disinfected individual pen. Dairy calves should be raised separately so as to prevent them from sucking or licking

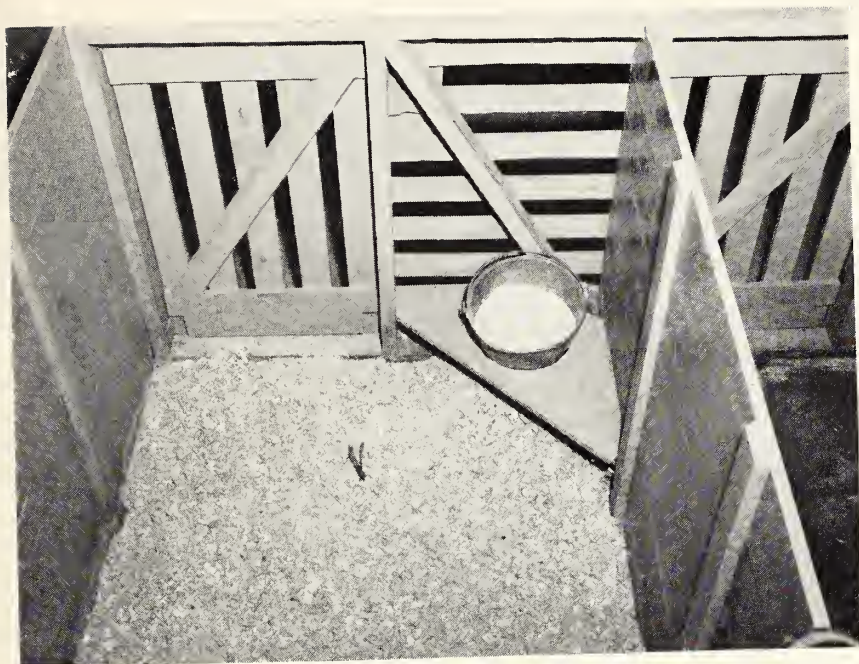


FIG. 1.—Individual pen with clean, dry bedding.

each other. This lessens the transmission of disease between calves, prevents the formation of hair balls in the calf's stomach, and prevents the development of a blind quarter. It is recommended by the Nutrition Council of the American Feed Manufacturers Association (24) that the minimum pen size be 24 square feet with solid partitions between pens. Automatic drinking cups are sometimes preferred for calf waterers and should be 20 inches from the floor. They should be located at a front corner of the pen away from the feed. If pails are used for supplying water, they should be kept clean and well filled with fresh water. Feed boxes should be 8" x 10" x 6" deep, and it is desirable to make boxes removable for cleaning. The top of these feed boxes should be 20 inches from the floor and they should be located at the front of individual pens away from the water. Clean bedding should be provided at all times.

A recent development is the use of the raised platform and heavy grating for the calves to stand and rest on. On the raised platform the calves are removed from the cold (wet) floor during the winter months and the bedding remains drier because the urine runs through the grating onto the floor. Since the bedding remains cleaner the calves do not have as great a chance to pick up and eat dirty bedding.

A study of the effect of type of floor in raising calves was made at Louisiana State University by Burch *et al.* (7) Twenty Jersey and Holstein calves of the University herd were used in the following groups: Group I—concrete floor with shavings; Group II—elevated wire floor with shavings; and Group III—elevated wire floor without shavings. All calves were fed alike according to recognized feeding standards. The average daily gains for Jersey and Holstein calves through four months of age are given in Table 1.

TABLE 1.—Average daily gains of calves at 4 months of age when raised on various types of floors

Group	Type of floor	Jersey	Holstein
		lb.	lb.
I—Concrete and shavings		0.78	0.85
II—Elevated wire and shavings.....		0.84	0.92
III—Elevated wire		0.75	0.97

There were no apparent differences among the various groups as to rate of growth and health. It was concluded that dry bedding rather than type of floor is the most important factor in raising healthy and vigorous calves in Louisiana.

IV. FEEDING THE CALF

a) **Colostrum**—It is very important that the calf receive colostrum (first milk that the cow secretes after she has dropped a calf) for the *first 3 days* because of its content of high nutritional and immunizing factors. Colostrum is highly nutritious, containing about twice as much milk solids as normal milk, much more protein, minerals, and vitamins, especially vitamin A and riboflavin. It gives passive immunization against infections and respiratory diseases because of its content of globulin antibodies. Colostrum also acts as a mild laxative and aids the digestive tract to begin its normal function. In Missouri, an experiment showed that 30 per cent of the calves that received no colostrum died (10).

The length of time to leave the calf with its dam during the colostrum feeding period is still controversial. However, if the calf and dam are both considered, it is probably best to remove the calf from the dam as soon as possible, so that one will definitely know the amount of milk the calf obtains. Overfeeding may cause severe digestive disturbances. Also, the cow's udder will not be so apt to be injured by the butting of the calf. At Louisiana State University, the practice is to allow the calf to nurse its dam for 24 hours; then milk the colostrum and feed it to the calf twice a day. The amount fed at each feeding should be

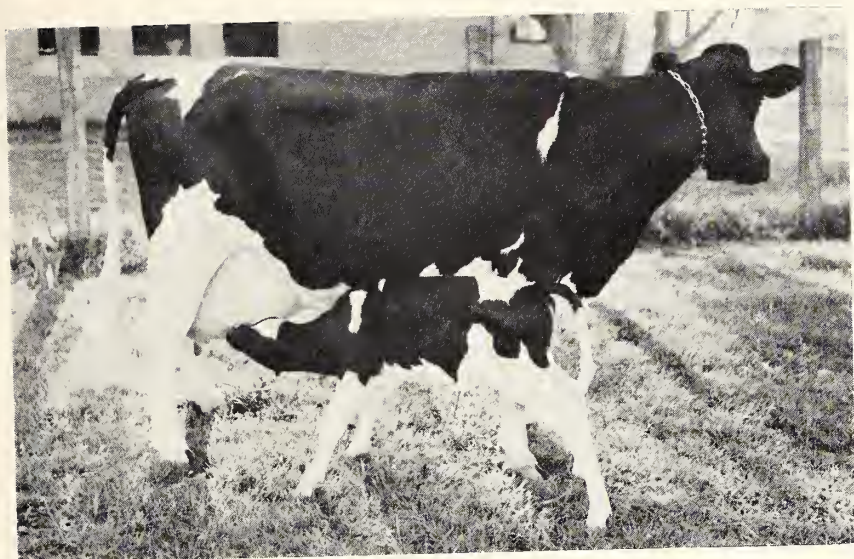


FIG 2.—Newborn calf obtaining its first fill of colostrum.

at the rate of $\frac{1}{2}$ pound per 10 pounds of body weight (1 lb. per 10 lbs. body weight daily), so that approximately 5 pounds of colostrum will be fed daily to a 50-pound calf.

Within recent years several investigators have recommended extending the period of feeding colostrum to calves until 6 months of age when colostrum is available. Kaeser and Sutton (14) have raised dairy calves on colostrum alone. They fed calves colostrum up to 6 months of age and observed more rapid growth, higher carotene and vitamin A values in the blood plasma, and superior physical appearance. The calves did not scour and did not create any special management problems when changed to no colostrum, or vice versa. The colostrum was stored in a frozen condition until ready for use. The practice at Louisiana State University is to freeze excess colostrum in quantities adequate for one feeding in order to have this valuable feed available for emergency cases. Excess colostrum is also mixed with the regular calf milk in any quantity that happens to be available.

b) Milk Feeding— There are many successful methods of feeding and raising dairy calves. However, the high cost of feed and present milk prices make the cost of raising calves high. To raise a calf as economically as possible it is recommended that the calf be fed a minimum of whole milk, with the main emphasis upon getting the calf on milk replacements or calf starters and hay at an early age. The calf may be raised on its dam or on a nurse cow if there is a surplus of milk.

Since the mortality rate of calves is highest during the first 6 weeks of their life, special precautions should be taken during this relatively short time. The amount of milk fed should be weighed or measured accurately at each feeding. The milk should be warmed to 100° F before feeding it to the calf. A thermometer should be used, since the hands are not accurate measures of temperature. Utensils should be kept clean and feeding done regularly.

One of the most popular and satisfactory systems of limited milk feeding of dairy calves is that recommended by Turk (35) of Cornell. A definite daily amount of milk is fed each week. The larger breeds receive milk up to 8 weeks of age and the smaller breeds through 10 weeks (Table 2).

TABLE 2.—Cornell milk feeding schedule (lbs. per day)

Week	1	2	3	4	5	6	7	8	9	10
Large breeds	8	9	10	9	7	6	4			
Small breeds	5	6	7	7	8	8	5	4	3	3

At the beginning of the second week the calf is offered a calf starter, and at the beginning of the third week hay is placed before the calf. Milk is gradually decreased during the fourth week for larger calves and during the sixth week for smaller calves. Weaning from milk should be completed at approximately 50 days of age for calves of the Holstein, Ayrshire, and Brown Swiss breeds, and at approximately 70 days of age for the Guernsey and Jersey breeds. At this time the calf should be eating nearly 3 pounds of calf starter daily.

At Louisiana State University the Cornell milk feeding system has proved very satisfactory in raising calves (5). In an attempt to save more milk for human consumption, experiments have been carried out in an effort to reduce the amount of milk fed to calves. A modification of the Cornell system (Table 3) was found to be very satisfactory and less expensive than was the Cornell system for raising Holstein calves when the starter was figured at \$6.20 per hundredweight and the milk at \$6.11 per hundredweight. There was no difference in the cost of raising Jersey calves to 4 months of age by the two systems. Since the use of a home-mixed

TABLE 3.—The Cornell and modified Cornell systems of milk feeding for Holstein and Jersey calves

Weeks of Age	1	2	3	4	5	6	7	8	9	10	Total
Pounds milk fed daily to Holsteins (Cornell)	8	9	10	9	7	6	4				371
Pounds milk fed daily to Holsteins (Modified) ...	8	9	8	6	5	3					270
Pounds milk fed daily to Jerseys (Cornell)	5	6	7	7	6	6	5	4	3	3	364
Pounds milk fed daily to Jerseys (Modified)	5	6	7	6	5	4	3	2			264

starter would have been considerably cheaper, the modified system would have been more economical.

Calves at Louisiana State University have been weaned successfully from whole milk at one month of age when good management and feeding practices were used. Milk was fed from a nipple pail at a ratio of 1 pound to 10 pounds of body weight in two feedings. A 20 per cent digestible calf starter and good quality hay were placed before the calf at 1 week of age. This limited milk feeding plan is especially good for Holstein calves. Special care should be taken of Jersey calves on this milk feeding plan, and unless they are consuming at least 2 pounds of calf starter per day and some hay when they are weaned at 1 month of age, a temporary set-back in growth may occur. It is recommended for Louisiana farmers that Jerseys be fed whole milk until 5 weeks of age. A source of vitamin A must be supplied to the calf when whole milk feeding is discontinued until sufficient good-quality green leafy hay is being consumed. Fish liver oils or synthetic dry vitamin A (Quadrex) have been used in our research with good success. The recommendations of the manufacturer should be followed in determining the amount of vitamin A supplement to feed.

c) **Nipple Pail vs. Open Pail**— The use of a nipple pail (Fig. 3) in place of the ordinary open pail is the latest trend in feeding



FIG. 3.—Feeding milk by nipple pail.

milk. When calves are fed milk from a nipple pail the milk is shunted directly into the fourth compartment or true stomach, where normal milk digestion begins. With ordinary pail feeding, the large swallows of milk exert a pressure against the muscular walls of the esophageal groove so that the milk gets into the undeveloped paunch or rumen. This milk might undergo fermentation, producing toxic factors which could cause scours and other digestive disturbances.

Wise and Anderson (38) observed that as much as 50 per cent of the milk ingested passed into the rumen when drunk from an open pail, whereas milk rarely passed into the rumen when ingested from a nipple pail. At Louisiana State University, Rusoff and Estess (30) compared the nipple pail and open pail methods of feeding milk with 24 Jersey calves. The open pail method of milk feeding caused a pot-bellied condition among most of the calves and 57 per cent more nutritional scours than did the nipple pail method. Whole milk was fed at the rate of 1 pound for each 10 pounds of body weight up to 30 days of age. At 90 days of age, however, there was no significant difference in gains in body weight between calves fed by either method.

d) **Skim Milk Feeding**—Where skim milk is available and a good price is being paid for whole milk, it is economical to replace some of the whole milk with skim milk. Skim milk powder mixed with water (1+9) costs about one-third as much as whole milk. Burch and Frye (6) at Louisiana State University used 3 groups of calves consisting of 4 Jerseys and 4 Holstein calves each to determine the length of time calves should be fed skim milk. All groups received colostrum for 3 days and then whole milk (1 pound to 10 pounds body weight) until 14 days of age, after which time they were gradually changed over to skim milk. All calves were fed a 16 per cent grain ration and a medium quality legume hay *ad libitum*. Group I received skim milk (1 pound to 10 pounds body weight) for 4 weeks; Group II, skim milk for 6 weeks; and Group III, skim milk for 8 weeks. The average daily gains at 6 months of age are shown in Table 4.

TABLE 4.—Average daily gains of calves fed skim milk for various intervals

Group	Skim milk fed for	Jerseys	Holsteins
		(lb.)	(lb.)
I.....	4 weeks	1.07	1.29
II.....	6 weeks	0.98	1.34
III.....	8 weeks	0.99	1.29

It can be observed that there was no significant difference in the gains of the different groups.

It is very important to supply a source of vitamin A in the ration when whole milk is discontinued, since the milk fat is a natural source of this vitamin. A vitamin A supplement in the form of fish liver oil or synthetic vitamin A was used in the above studies.

e) Calf Starters— In order to raise calves on a limited amount of whole milk, a good calf starter is necessary. It is generally agreed that about a 20 per cent protein starter is required. Both animal and vegetable proteins have been used in studies with calf starters at Louisiana State University (29). A calf starter containing 19.4 per cent digestible protein which has been used successfully with limited milk is shown in Table 5.

TABLE 5.—Composition of calf starter

Ingredient	Lb.
Cottonseed meal	35
Soybean oil meal	5.5
Yellow corn meal	31.5
Rolled oats	15
Wheat bran	10
Steamed bonemeal	2
Salt	1
	100
plus	
Aurofac A ¹ (aureomycin feeding supplement..	1
Quadrex IV ² or other dry stable vitamin A forms..	0.2 gm.

¹ Made by Lederle Laboratories Division, American Cyanamid Co., Pearl River, N. Y., and contains at least 1.8 gm aureomycin per pound.

² Made by NOPCO Chemical Co., Harrison, N. J., and contains 10,000 units of Vitamin A per gram.

The calf starter and a good quality lespedeza hay were fed at 8 days of age. In earlier experiments it was found that a calf starter containing 5 per cent meat scraps, or fish meal or skim milk powder gave similar results. Also, there was no difference in the performance of a calf starter when animal protein in the form of meat scraps was increased from 5 per cent to 15 per cent in the starter. As mentioned previously, a source of vitamin A must be given the calves when no whole milk is fed. Fish liver oils (shark liver oil and cod liver oil) or a dry stable vitamin A supplement can be incorporated into the starter.

The question often arises as to whether it is more economical to purchase a commercial calf starter or to mix one's own starter. This would depend mainly on the number of calves to be fed and the availability of ingredients. One should always keep in mind that calves prefer a fresh feed. For the dairyman who raises a

few calves it would probably be most satisfactory to purchase a commercial starter. However, for those farmers who have home-grown feeds or who can obtain feeds at a reasonable price, the following calf starter may be used.

L. S. U. simple starter

Ingredient	Lbs.
Crimped oats.....	48.5
Yellow corn meal.....	48.5
Steamed bonemeal.....	2
Salt.....	1
	100
plus	
Aurofac A (aureomycin feeding supplement)....	1
Quadrex IV or other dry stable vitamin A forms	0.2 gm.

f) Hay—Investigators are agreed that the hay fed to young calves should be the finest-stemmed, leafiest, highest quality hay. There is no other feed which will take the place of high quality hay for the dairy calf. The time a calf should be given hay is still controversial. Some investigators recommend 3 or 4 weeks of age after the calf starts consuming 2 to 3 pounds of starter, others after 1 week of age. At Louisiana State University some preliminary research has been done as to the time that hay should be fed a calf. There appeared to be no particular advantage in waiting longer than 7 to 10 days of age to begin hay feeding. The quicker the calf starts eating hay, the quicker the rumen develops and the earlier the calf can be placed on pasture. Furthermore, the consumption of hay decreases the grain requirements of the calf. Good quality leafy green hay usually contains high amounts of carotene (vitamin A), which is required for good health and normal growth.

g) Water—Water should be given to the young calf after milk feeding and should be available at all times. The water should be warm when fed to the very young calf or else digestive disturbances may occur.

V. VITAMINS

Vitamin A (carotene=provitamin A)—It is very important that the young growing calf obtain carotene or vitamin A in its diet (9, 15, 17). It has been found that the calf at birth has a low supply of vitamin A in its body. Feeding colostrum, which is an excellent source of vitamin A, corrects this low level of vitamin A in the calf. Whole milk usually contains adequate amounts of carotene and vitamin A in the butterfat. When whole milk feeding is discontinued, a source of vitamin A must be supplied the

calf or vitamin A deficiency symptoms appear. These symptoms of inadequate vitamin A include general weakness, unthriftiness, failure to grow, scours, respiratory troubles, pneumonia, and night blindness.

As mentioned previously, fish liver oils or dry vitamin A concentrates can be supplemented to the skim milk or calf starter. The amounts to use are recommended by the manufacturer. Most commercial calf starters contain adequate sources of vitamin A. Green succulent pastures and green leafy hays contain provitamin A or carotene, a yellow plant pigment which changes into vitamin A in the animal body. When a calf is consuming sufficient amounts of high quality leafy hay, a vitamin A supplement in the starter can be omitted. The young calf is usually not placed on pasture until 8 to 10 months of age, and therefore it is important that a source of vitamin A be fed to the growing calf up to this time.

Vitamin D (Ergocalciferol= D_2 and Cholecalciferol= D_3)—This vitamin, known as the calcifying vitamin, is necessary to prevent rickets in calves (3). This is manifested by abnormal bone development, swollen joints, bowed legs, slight paralysis of the rear quarters, a bowed back, and decreased growth rate. Since sunlight is the best natural source of vitamin D, Louisiana dairymen do not have to worry about a vitamin D supplement in the calf starter if the calf is exposed to sunshine. Fish liver oils, as well as dry vitamin supplements, also contain vitamin D along with vitamin A and can be put in the calf starter. Green sun-cured hays are good sources of vitamin D but exposure to sunlight destroys some of the carotene or vitamin A activity.

Vitamin E (Tocopherols)—No deficiency due to a lack of this vitamin has been reported in calves. Most feeds contain sufficient vitamin E.

Vitamin K (Naphthoquinone)—No deficiency of this vitamin has been reported in calves.

Vitamin C (Ascorbic Acid)—Research has shown that calves can synthesize their own ascorbic acid (34). Therefore calves do not need this vitamin in their diet.

B Complex Vitamins—It is generally established that ruminants can synthesize their own vitamin B family in their rumens (paunch) and therefore do not need supplementary vitamins in their ration. In the case of young calves, their rumens are not functioning until they are 1 to 4 months of age, and therefore some of the B vitamins may have to be supplied in the calf starter.

Usually grains are good sources of the B vitamins, and milk contains appreciable quantities. It is only in extreme cases that

deficiencies occur. The following is the information on B vitamin deficiencies in calves.

Thiamin (Vitamin B₁)—Johnson *et al.* (12) of Illinois reported that calves on a low thiamin diet developed pathological signs characterized by weakness, incoordination of the legs, convulsions, and head retraction; and in some cases severe scouring, anorexia, and dehydration.

Riboflavin (Vitamin B₂)—Wiese *et al.* (36) of Illinois reported that riboflavin was required by the bovine species either in their diet or by rumen or intestinal synthesis. On a riboflavin-deficient diet calves developed pathological symptoms. The symptoms were lesions in the corner of the mouth, along the edges of the lips, and around the navel, hyperemia of the buccal mucosa, poor growth, loss of appetite, scours, excessive salivation and lacrimation, and loss of hair.

Niacin (Nicotinic acid or PP factor)—Lundquist *et al.* (19) of Wisconsin reported that nicotinic acid was essential for dairy calves for the prevention and the control of calfhood diseases. On the other hand, Johnson *et al.* (13) of Illinois stated that a young calf did not require nicotinic acid in the diet.

Pyridoxine (Vitamin B₆)—Johnson *et al.* (13) of Illinois reported that pyridoxine is necessary for the young calf. Symptoms developed by the calf on a diet deficient in pyridoxine were poor growth, lack of appetite, sluggishness, anorexia, poor hair coat, fits, and death.

Biotin (Avidin)—Wiese *et al.* (37) of Illinois reported that calves require an exogenous supply of biotin; otherwise, paralysis of the hind quarters develops.

Cobalamine (Vitamin B₁₂), Cyancobalamine (B_{12a}), Hydroxycobalamine (B_{12b}), and Nitrocobalamine (B_{12c})—Rusoff and Haq (32) of Louisiana reported that the supplementation of an all-plant protein calf starter with a vitamin B₁₂ concentrate was of no value in stimulating extra growth of calves up to 13 weeks of age when they were weaned from milk at 28 days of age. Milk is a good source of vitamin B₁₂.

VI. MINERALS

Although thirteen essential minerals (calcium, phosphorus, magnesium, manganese, iron, copper, cobalt, sodium, potassium, chlorine, iodine, sulphur, and zinc) are required for good nutrition, only four—calcium, phosphorus, sodium and chlorine—have been found to be required in the diet of Louisiana dairy cows (33). Milk contains these minerals, and therefore supplemen-

tation should be made when milk feeding is discontinued. It is recommended that the calf starter contain 1 per cent common salt and 2 per cent steamed bonemeal or dicalcium phosphate, or 1 per cent common salt, 1 per cent oyster shell flour and 1 per cent defluorinated phosphate. Common salt is necessary for the formation of hydrochloric acid in the gastric juice and osmotic pressure relationships in the body. Oyster shell supplies calcium and phosphate supplies phosphorus. Steamed bonemeal or dicalcium phosphate supplies both calcium and phosphorus, which are essential, along with vitamin D, for normal skeletal development. A small block of common salt also should be available to the calf at all times.

VII. ANTIBIOTICS

Several antibiotics (aureomycin, bacitracin, penicillin, streptomycin, and terramycin) have proved to be of value in the nutrition and well-being of chicks, turkeys, pigs, and other non-ruminants. In ruminants, only aureomycin has been definitely established as being beneficial to young calves, resulting in increased growth, reduced incidence of scours, improved physical appearance, and better feed efficiency up to 16 weeks of age. A few reports have indicated that terramycin is of some benefit to calves (8, 16, 21). Potassium and procaine penicillin have been reported to be harmful to calves, while tyrothricin and bacitracin have been shown to be without effect.

In 1950, Rusoff (25) of Louisiana, Bartley *et al.* (1) of Kansas, and Loosli and Wallace (18) of Cornell were the first to report favorable growth responses in the feeding of aureomycin to young calves. Since 1950 a great deal of evidence has accumulated which has definitely demonstrated that young calves benefit from aureomycin feeding (2, 4, 11, 20, 23, 26, 27, 28).

Rusoff (25) in 1950 fed a 2 per cent level of an antibiotic (aureomycin) feeding supplement (2.5 mg. aureomycin per gram) to Jersey male calves (14 weeks of age) which were on a simple all-plant protein ration consisting of 1 part cottonseed

TABLE 6.—A. P. F. aureomycin feeding supplement for calves

Group	No. of Calves (Jerseys)	Average daily gain (lb.) per calf										
		Weeks of age										
		14	16	18	20	22	24	26	28	30	32	34
Basal	5	0.79	0.92	1.04	1.10	1.42	1.40	1.54	1.70	1.68	1.69	1.66
Basal + 2% aureomycin supplement*	5	0.78	1.48	1.43	1.44	1.53	1.50	1.59	1.73	1.61	1.68	1.65

* The A. P. F. supplement contained approximately 2.5 mg. of aureomycin per gram.

meal, 3 parts yellow corn meal, 2 per cent bonemeal, and 1 per cent salt. The animals were allowed some lespedeza hay and pasture. Table 6 shows the results of the trial for a 20-week period. During the first six weeks of the trial the aureomycin group had outgained the control group by approximately 60 per cent, 36 per cent, and 30 per cent, respectively, for the 2-week periods. After six weeks the supplemented group had an average daily gain of 1.43 pounds per day, while the control group averaged only 1.10 pounds per day. After this time the gains became less significant until at the end of the trial (20 weeks, 8½ months of age) the control calves showed the same gain (1.66 pounds) as the calves receiving the supplement (1.65 pounds). The aureomycin group had a smoother hair coat and a more solid muscular appearance than did the control calves.

Rusoff *et al.* (28) in 1951 determined the effect of an antibiotic (aureomycin) feeding supplement and crystalline aureomycin on the growth of calves through 16 weeks of age. Twenty-four purebred Jersey and Holstein newborn calves were divided into three comparable groups. Group I (control) received a 19.4 per cent digestible protein calf starter containing no animal protein; Group II, the calf starter supplemented with a 2 per cent aureomycin feeding supplement (2.5 g. aureomycin per pound of supplement); and Group III, the calf starter supplemented daily with 75-150 mg. of crystalline aureomycin fed by capsule. All the calves were weaned from milk at 30 days of age; they were fed the calf starter and medium quality clover hay free choice beginning at 7 days of age. The crystalline aureomycin feeding was also begun at 7 days of age. Table 7 shows the results of the feeding trial. It can be seen from this table

TABLE 7.—The effect of aureomycin supplements on the average growth rate, feed efficiency, and incidence of diarrhea in dairy calves through 16 weeks of age

Group and Ration	Average daily gains (lb.)			Average lb. of starter consumed per lb. of gain		Average incidence of scours (days)	
	Jerseys	Holsteins	Group	Jersey	Holstein	For 16 wk.	After 30 days (Weaning)
I. Basal	0.99±0.1	1.40±0.03	1.19	2.47	2.32	2.5	2.0
II. Basal + aureomycin supplement	1.21±0.09	1.69±0.14	1.45	2.64	2.07	2.0	0.6
III. Basal + crystalline aureomycin	1.28±0.08	1.61±0.01	1.44	2.44	2.16	0	0

that aureomycin definitely produced a growth stimulation in young calves. The Jersey calves receiving the aureomycin feeding supplement and those receiving the crystalline aureomycin showed a gain of approximately 25 per cent over the Jersey control calves. The Holstein aureomycin groups showed a gain of approximately 15 per cent over the Holstein control group. The combined daily gain for the supplemented calves of both breeds was 1.44 pounds as compared to 1.19 pounds for the controls. The antibiotic supplementation also lowered the incidence of scours. Since the aureomycin supplement and the pure aureomycin showed similar gains this work proves that the increased growth response was due to the antibiotic itself and not to some unknown growth factors which might be present in the supplement.

To determine whether or not the rumen microflora were affected by the antibiotic which might influence growth, a study (28) of the rumen contents of the calves was undertaken in cooperation with Dr. Alford of the Bacteriology Department at Louisiana State University. This study of the effect of aureomycin on the rumen flora of calves failed to reveal any change in the usual microscopic appearance when protozoa and morphological groups of bacteria were used as the indicator organisms.

In 1952, Rusoff, Alford, and Hyde (27) made a study of the effect of type of protein on the response of young dairy calves to aureomycin. An aureomycin supplement was fed. A 27-37 per cent level of soybean meal, cottonseed meal, or degossypolized cottonseed meal was used in the calf starter. Thirty-six purebred male calves (18 Holsteins and 18 Jerseys) were divided into 3 groups. One-half of each received the antibiotic starting at 4 days of age. Fifty milligrams of crystalline aureomycin HCl were added daily in the milk for 27 days; the calf starters which contained a 1 per cent level of an aureomycin supplement were fed at 8 days of age. The remaining animals in each group served as controls. All calves were weaned from milk at 30 days of age. At 16 weeks of age, the calves on the soybean oil meal starter plus aureomycin showed the best gains (Table 8). An increased feed efficiency was also obtained on this ration. This study showed that the type of ration influenced the growth stimulation in calves being fed aureomycin.

A study of the microflora of the feces of these calves was also made. Fecal samples were obtained biweekly from representative calves on all rations until they were 9 weeks of age. The following bacterial counts were made: aerobic, anaerobic, carrot-liver shake tubes (lactics?), coliforms, enterococci, and H₂S-producing

TABLE 8.—Effect of aureomycin on the average growth rate, feed efficiency, and incidence of diarrhea in dairy calves through 16 weeks of age

Group and Ration		Average daily gains (lb.)			Lb. of starter per lb. gain			Average incidence of scours (days)
		Holstein	Jersey	Group	Holstein	Jersey	Group	
I								
Soybean oil meal	Basal	1.33	.90	1.11	2.24	2.11	2.17	2.0
	Aureomycin	1.60	1.06	1.33	1.99	2.10	2.04	0
II								
Cottonseed meal	Basal	1.36	.86	1.07	2.40	2.57	2.48	.2
	Aureomycin	1.50	.89	1.19	2.26	2.59	2.42	.2
III								
Cottonseed meal, de-gossypolized	Basal	1.24	.68	.96	2.60	3.06	2.84	.3
	Aureomycin	1.37	.89	1.13	2.29	2.40	2.35	0

anaerobes. The results are summarized in Table 9. All counts were considerably higher while the calves were receiving milk than after weaning. The bacteria in the carrot-liver medium were not typical lactics after the calves were weaned. There were wide variations between samples from different calves on the same ration. No correlation between the numbers of any group of bacteria and the presence of aureomycin in the diet was found. Again, the growth stimulation obtained by feeding aureomycin was not due to any effect on microflora of the intestines.

In 1953, Rusoff, Fussell, Hyde, and Crown (30) reported that intramuscular injections of aureomycin to young calves produced a growth stimulation of 30 per cent over control calves at 16 weeks of age. Oral-fed aureomycin stimulated growth by 20 per cent. In this study 24 male Jersey calves were divided into three groups. Group I served as a control, Group II received weekly intramuscular injections of approximately 400 mg. aureomycin (aureomycin in sesame oil as $AlCl_3$ complex), and Group III received 50 mg. aureomycin daily in the milk and a 1 per cent level of aureofac A (1.8 gm. aureomycin per lb.) in the calf starter. After receiving colostrum for three days, all calves were fed milk up to 30 days of age. An all-plant protein calf starter minus the aureomycin (Table 5) and good quality alcyce clover hay were fed to all calves at 8 days of age. Aureomycin feeding and injections were started at 4 days of age. The experiment was continued for 16 weeks.

TABLE 9.—The effect of aureomycin on different groups of bacteria in the feces of calves of various ages

[illegible]

() * No. of animals.

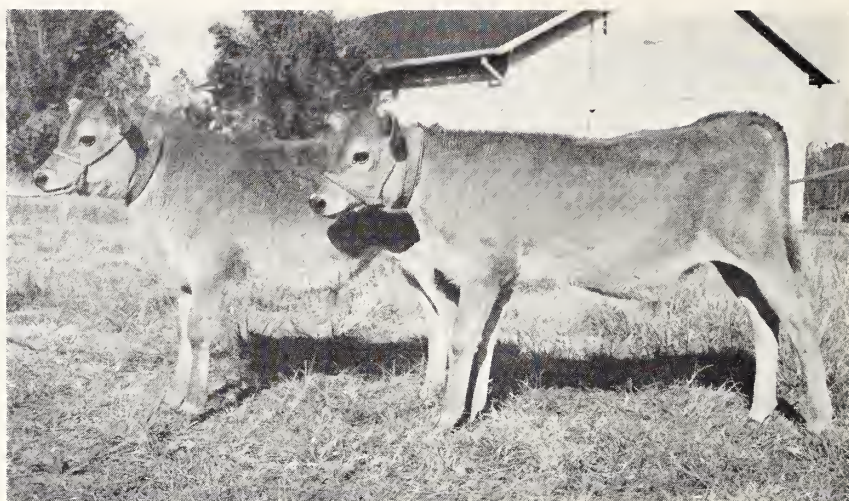


FIG. 4.—Calf on right received the antibiotic aureomycin; other calf received none. Note smooth hair coat of antibiotic calf. Both calves 12 weeks of age.

The aureomycin-injected calves showed excellent condition and smooth hair coat beginning at 9-10 weeks of age. The oral-fed aureomycin calves showed this bloom condition at 12-16 weeks (Fig. 4). Both aureomycin groups of calves significantly outgained the control group (Table 10). At 16 weeks of age, the average daily gains were 0.79, 1.07, and 0.94 pounds for Group I, II, and III, respectively. The antibiotic also caused a significant increase in height at withers.

TABLE 10.—Average daily gains, increase in height at withers, and feed efficiency of dairy calves at 16 weeks of age

Group	Average* daily gains (lb.)	Lb. of starter per lb. gain	Increase in height at withers* (in.)
I Control	0.78	3.13	5.99
II Injected aureomycin	1.07	2.67	7.59
III Oral aureomycin	0.94	2.79	6.44

* $P < 0.05$.

Carcass studies reflected the larger size and weight of the aureomycin groups. Meat yields showed larger muscles and skeletal size (Table 11).

A continuation of this work by Rusoff and Gall (31) involved a study of the rumen contents (flora and environment) of control calves, aureomycin-injected calves, and those fed aureomycin orally. No significant differences were found in rumen pH, Eh,

**TABLE 11.—Carcass studies and meat studies of calves at 16 weeks of age
(2 animals per group)**

Group	Carcass	Length	Meat (12th rib)		Cooking data (9-10-11 ribs)	
	Wt.	of body	Moisture	Fat	Before cooking	Loss after cooking
	lb.	cm.	%	%	g.	%
Control	74.8	727	68.95	2.82	424.5	11.19
Injected	110.5	832	65.87	7.28	619.0	11.07
Oral	95.8	795	67.82	3.62	505.5	13.25

degree of fiber digestion in the artificial rumen, rumen flora, and B vitamin content (B_{12} , pantothenic acid, riboflavin, niacin, biotin, pyridoxine, thiamine, and folic acid) of the rumen fluid.

On the basis of this past and present research, it is indicated that aureomycin stimulates general growth, and it is possible that the pituitary growth hormone is involved. The data on increase of height at withers and on bone size and weight, however, suggest that bone metabolism might be the area in which aureomycin exerts its effect.

It should be pointed out that aureomycin should not be expected to correct nutritional deficiencies in the ration. Adequate levels of protein, vitamins, and minerals are still required. Antibiotics are not a substitute for the nutrients needed but a supplement to them. Antibiotics should not be used as a substitute for good sanitary feeding practices and management. Results of feeding antibiotics may vary with the ration fed, condition of the animal, and sanitary conditions.

VIII. THE CALF ON PASTURE

The age at which the calf may be turned on pasture is a controversial subject and may differ from farm to farm or in different sections of the country.

It is an established fact that roughages (pasture, silage and hay) provide the cheapest source of nutrients for dairy animals. However, it must be remembered that the young calf does not have the stomach capacity to handle large quantities of high fiber and low digestible feeds. As the calf grows older the stomach compartment (paunch or rumen) which handles roughages increases in size and efficiency until it constitutes about 80 per cent of the total stomach capacity at maturity.

In the lowlands of South Louisiana best results are usually obtained in raising calves if they are dry-lot fed until they are at least 6-8 months of age. There is no advantage in pasturing calves until about 10 months of age unless the pasture is very palatable and low in moisture content. Calves turned on pasture in the spring months usually fail to make normal gains because

they cannot consume enough grass to furnish the nutrients required for normal growth. This may happen in spite of the fact that grain and hay feeding has been continued.

Studies at L.S.U. have shown that calves will grow faster and stay in a thriftier condition when barn-fed until about 8 to 10 months of age than when turned out to pasture at a younger age. Furthermore, observations indicate that they are more resistant to parasitic infestation at 10 months than they are at an earlier age.

IX. OTHER MANAGEMENT PRACTICES

First Month—During the first month the calf should be dehorned and tagged or tattooed. If scours occurs during milk feeding, the amount of milk should be reduced to one-half the amount fed daily and then gradually increased to the regular amount. In general, nutritional scours is a management problem. The use of the antibiotic aureomycin has reduced the incidence and severity of scours in calves at Louisiana State University. If scours persists, therapeutic or veterinary measures may be required.

After First Month—After the first month, extra teats should be clipped, and hoofs should be trimmed. Also, the calf can be vaccinated for anthrax, blackleg, and other diseases.

4 to 6 Months—Calves can be placed in groups.

8 to 10 Months—Calves can be allowed pasture along with grain and hay.

X. SUMMARY

Experimental work over the past 10 years in raising dairy calves in Louisiana is presented.

Various nutritional and management practices used are discussed in detail, including composition of calf starters.

An up-to-date resume of vitamin and mineral requirements of calves is included.

Since the Station has been one of the pioneers in antibiotic research, all work done in the department on the effect of aureomycin on the young calf is given in detail.

References to research and information given are also included.

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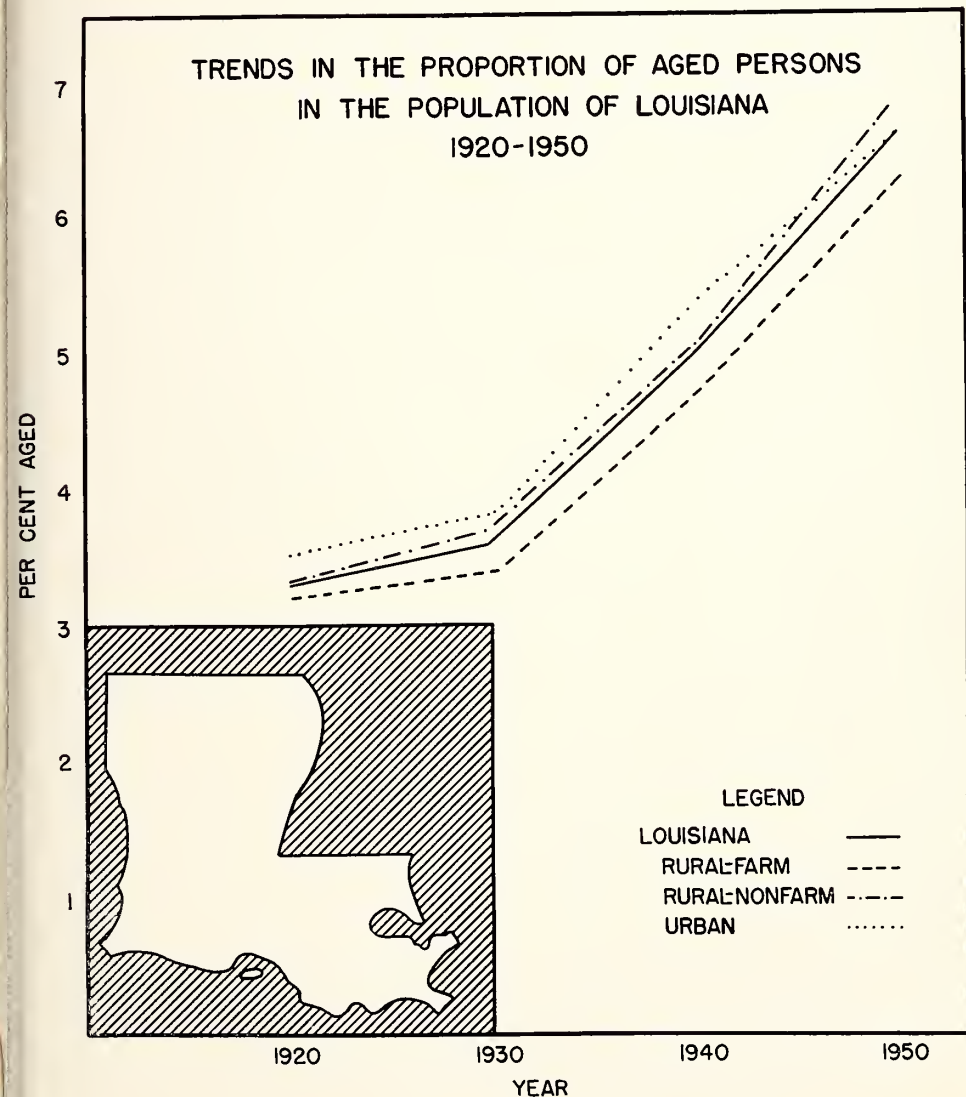


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IN LOUISIANA'S AGRICULTURE

by Paul H. Price and Homer L. Hitt



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The Aged in Louisiana's Agriculture

by

Paul H. Price and Homer L. Hitt

INTRODUCTION

In recent years attention and interest have been increasingly focused upon the role and status of aged persons in our society—and for good reason. The inescapable facts revealed by census enumerations are that elderly people have increased rapidly in number and relative importance since the beginning of the Twentieth Century. The impressive growth of oldsters assumes genuine significance in view of the peculiar constellation of problems which beset them in contemporary society. As a group, they are characterized by the multitude of health problems related to advanced age; many have dependency problems because they cannot continue to support themselves; they are frequently overwhelmed by emotional problems related to the loss of a husband or wife through death; they often have psychological or mental problems associated with the gradual deterioration of the physiological processes; and they have more than their share of sociological problems stemming from the lack of self gratifying and useful roles in society during the advanced years.

The objectives of this study are to analyze the status and characteristics of aged persons in Louisiana's rural-farm population and to compare their situation to that of the aged in the urban and rural-nonfarm areas of the state. As such, it represents somewhat of a departure from the usual research in this field. Most studies concerned with the aged have concentrated upon this group as a segment of the general population of the nation or of individual states. Although a number of investigations have been devoted to retirement plans of farmers, few have dealt primarily with the importance and status of aged persons in the rural-farm population.

It is hoped that this study will point up something of the nature and magnitude of the problem of the aged in Louisiana's farm population. By identifying and evaluating recent trends, the emerging pattern of the future can be better anticipated. It follows that the findings should contribute to the fund of information and understanding which must underlie intelligent planning for the aged people of the state engaged in agriculture.

METHODOLOGY

Two separate groups serve as the units of analysis in this study. One of these is the rural-farm population and the other is the farm operators of the state. These two groups were selected for study be-

cause through them the maximum insight into the status and importance of the aged in rural society could be gained. The study of the rural-farm population provides information relative to the total problem of the aged among farm people. This group includes producers as well as dependents and gives an over-all picture. The investigation of the status of the aged among farm operators yields information regarding the vital productive element in the farm society. In a strict sense, rural society is composed of the people involved in a particular occupation—farming. Farm operators are essential elements in the rural society because they are productive units within it. Their traits and activities do much to determine the general characteristics of the total rural society. The twofold analysis of the status of aged in the rural-farm population and among farm operators provides a concise picture of the importance of that age group in the agricultural life of the state.

In this analysis, persons 65 years of age and over are considered aged. The choice of this definition is conceded to be arbitrary. It should be remembered that many persons in actuality may be "aged" a number of years before age 65 and that others should not properly be so classified until many years beyond that age. Nevertheless, there are several justifications for using the 65th year as marking the threshold of old age. This is the age which has been established by the Social Security Program of the United States as the year of eligibility for retirement, and it is also widely recognized for this purpose by other public and private pension plans. Still further, there is biological evidence that for the majority of persons this age approximates the time of the onset of the physical decline which so often accompanies old age.

The analysis in all of its phases is made on a state basis and is further pursued on parish and State Economic Area levels whenever such a procedure is possible and feasible. That part of the study concerned with aged farm operators is made exclusively on the basis of State Economic Areas. The aged in the rural-farm population are compared to those in the rural-nonfarm and urban populations as well as to oldsters in Louisiana's three metropolitan areas, New Orleans, Baton Rouge, and Shreveport. This procedure points up the significant differences between aged persons in the rural-farm population and in the other residential categories of the state.

The aged in the rural-farm population are analyzed according to their social and economic position in the society. The marital and family statuses of aged persons are studied, as is their educational status. The types of employment and levels of income of these elderly persons are also examined. Moreover, and of basic importance, their number and distribution within the rural-farm society of the state and their sex and racial compositions are thoroughly investigated.

An attempt is made to describe the number, distribution, and racial composition of aged farm operators in the state. Beyond this, the sig-

nificant characteristics of farm operators are examined as they relate to the aged. Among these are tenure status, type of farming operation, size of farming operation, and economic status of the farming operation. These factors are studied from two viewpoints. First, they are considered in the manner in which they apply to the aged farm operators themselves, and secondly, they are viewed as they differentially pertain to aged farm operators as compared to all operators.

In the analysis of both aged farm operators and aged persons generally in the rural-farm population, an attempt is made to point out trends which indicate future developments that policy makers should take account of in their formulations of programs for aged farm people.

THE AGED RURAL-FARM POPULATION

Basically, rural society is composed of persons working in a particular occupation—agriculture. The United States Census has, for several decades, collected data relating to people living on farms. This group is called the rural-farm population.¹ An analysis of these data is the most direct and reliable means of determining many of the fundamental conditions which prevail among the farm people in the state. Therefore, the first portion of this analysis is focused upon the status and importance of aged persons in the rural-farm population. This approach gives insight into the characteristics of aged women and men regardless of their precise relationship to the operation of a farm.

Number and Distribution

In 1950 there were 35,629 persons 65 years of age and over in the rural-farm population of Louisiana. This group comprised 6.3 per cent of the total rural-farm population. In 1920, the aged constituted only 3.2 per cent of the farm population. In the state in 1950, there were 176,849 persons in this age group which accounted for 6.6 per cent of the total population. Therefore, the aged were of slightly less relative importance in the rural-farm population than in the total population of

¹The United States Census states as follows: "The farm population for 1950, as for 1940 and 1930, includes all persons living on farms without regard to occupation. In determining farm and nonfarm residents in the 1950 Census, however, certain special groups were classified otherwise than in earlier censuses. In 1950, persons living on what might have been considered farm were classified as nonfarm if they paid cash rent for their homes and yards only. Some persons in institutions, summer camps, 'motels,' and tourist camps were classified as farm residents in 1940, whereas in 1950 all such persons were classified as nonfarm." United States Census of Population, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, p. v.

The United States Census of Agriculture states that "For the 1950 Census of Agriculture, places of 3 or more acres were counted as farms if the value of agricultural products in 1949, exclusive of home gardens, amounted to \$150.00 or more. The agricultural products could have been either for home use or for sale. Places of less than 3 acres were counted as farms only if the value of sales of agricultural products in 1949 amounted to \$150.00 or more. Places operated in 1949 for which the value of agricultural products in 1949 was less than these minima because of crop or other unusual situation, and places operated in 1950 for the first time were counted as farms if normally they could be expected to produce these minimum quantities of farm products." United States Census of Agriculture, 1950, *General Report* "Age, Residence, Years on Farm, Work Off Farm," Chapter II, pp. xxix.

the state. In the United States, the aged constituted 8.2 per cent of the nation's population. This means that the process of aging in both the total and rural-farm populations of Louisiana has not yet progressed to the extent that it has in the nation as a whole. The present age structure of the population, viewed in relation to prevailing mortality rates, makes it appear certain that the number and proportion of the aged in both the state and the nation will increase substantially in the decades immediately ahead. The proportion of the aged, however, is less amenable to prediction than the number because of its sensitivity to changes in the birth rate as well as in mortality at all levels.

An examination of the relative importance of the aged within the rural-farm populations of the different parishes indicates that considerable variation exists.² In order to portray these variations, Figure

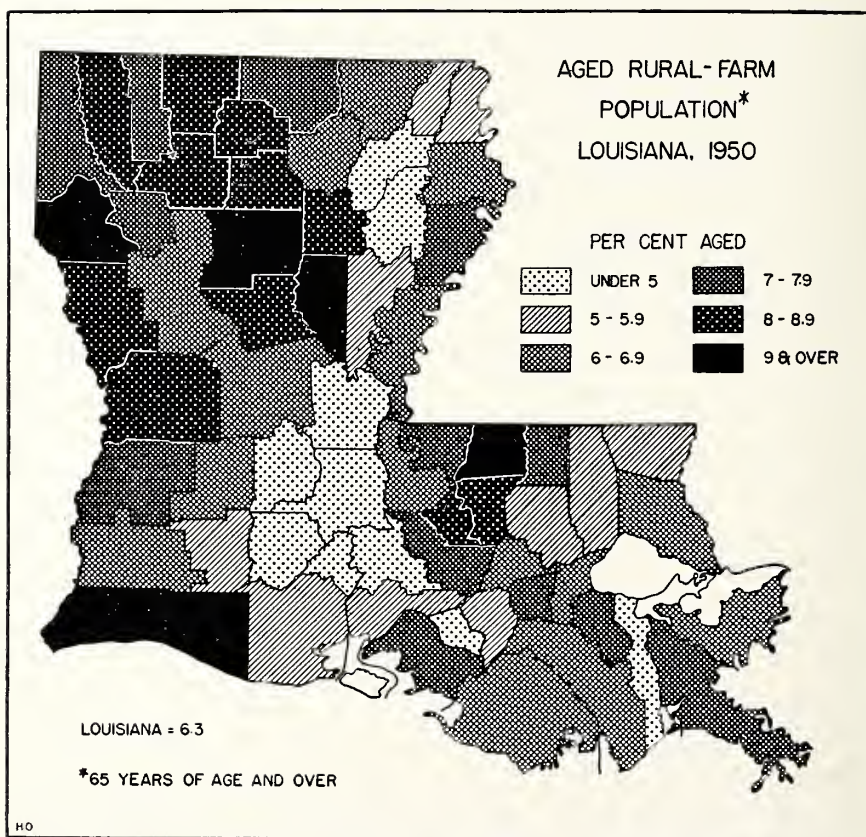


FIGURE 1—The Aged Rural-Farm Population of Louisiana, by Parishes, 1950. (Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18.)

² In Louisiana, parishes are the political subdivisions which correspond to counties in other states.

1 showing the relative importance of the aged rural-farm population of Louisiana, by parishes, in 1950 has been prepared. (See Appendix Tables I, II, and III which present the proportional representation of the aged for the different parishes by race and residence.) This figure reveals that in five parishes the aged constituted 9 per cent or more of the rural-farm population in 1950. These are Cameron (9.3 per cent), De Soto (9.5 per cent), East Feliciana (9.5 per cent), Winn (9.6 per cent), and La Salie (9.8 per cent) parishes. On the other hand, in nine parishes the aged made up less than 5 per cent of the total rural-farm population. This condition obtains in Franklin (4.9 per cent), Richland (4.8 per cent), Avoyelles (4.7 per cent), Jefferson (4.6 per cent), Acadia (4.4 per cent), Lafayette (4.3 per cent), St. Martin (4.0 per cent), St. Landry (3.3 per cent), and Evangeline (3.0 per cent) parishes. Among the remaining parishes, the aged constituted 5.0 - 5.9 per cent of the rural-farm population in 10 parishes, 6.0 - 6.9 per cent in 15 parishes, 7.0 - 7.9 per cent in 13 parishes, and 8.0 - 8.9 per cent in 11 parishes. One parish (Orleans) has no rural-farm population.

From the standpoint of absolute numbers of aged persons in the rural-farm population, six parishes had more than 1,000 residents each aged 65 years and over in 1950. These were St. Landry (1,236 persons), Tangipahoa (1,213 persons), De Soto (1,153 persons), Franklin (1,078 persons), Caddo (1,075 persons), and Natchitoches (1,017 persons). At the other extreme, 3 parishes had less than 100 aged persons in their rural-farm populations. St. Charles (95 persons), Jefferson (44 persons), and St. Bernard (40 persons) were in this category.

Sex Composition

In sharp contrast to the balance between the sexes among the aged in the other residential categories, the sex ratio among elderly people in the rural-farm population is high. (See Table I.) In 1950 there were 129.5 males for each 100 females in the rural-farm population 65 years of age and over. This means that the aged rural-farm population is predominantly male. Among the aged of the state as a whole the sex ratio was only 87.5. Corresponding figures for the rural-nonfarm and urban

TABLE I.—Sex Ratios Among Persons 65 years of Age and Over, by Race and Residence, Louisiana, 1950

Area	Total Population	Sex Ratio	
		Whites	Nonwhites
<i>The State</i>	87.5	84.7	92.9
Rural-Farm	129.5	124.5	137.8
Rural-Nonfarm	96.9	98.9	93.9
Urban	71.3	69.2	76.2
Baton Rouge	69.8	61.5	83.2
New Orleans	66.1	65.2	68.9
Shreveport	83.3	80.6	86.9

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 57.

populations were 96.9 and 71.3, respectively. Low sex ratios among the aged also prevailed in Louisiana's major cities: Baton Rouge (69.8), Shreveport (83.3), and New Orleans (66.1). These figures indicate that the aged in the rural-nonfarm and urban population of the state are numerically female dominated. This is a highly significant factor in the composition of the aged rural-farm population as contrasted to the other segments of the state's people. (See Appendix Tables IV and V for sex ratios for parishes by race and residence.)

A consideration of the sex composition of the rural-farm aged population by race reveals that this important distinction holds for whites as well as nonwhites. Specifically the sex ratio was 124.5 among white elderly farm people and 137.8 among the corresponding nonwhite group. Thus, the nonwhite aged rural-farm population is considerably more masculine than is the white aged farm population. In comparison, the aged residents of both races in rural-nonfarm and urban areas are characterized by low sex ratios, i.e., by a relative numerical dominance of females.

That Louisiana's aged people on farms are more masculine than those in cities and rural-nonfarm areas is to be expected in view of the characteristically higher sex ratios of farm populations generally. However, the substantially greater masculinity of the aged farm people as compared with all farm people in the state is somewhat surprising since females have a clear-cut advantage in life expectancy. It would seem that the migration of widowed aged women away from farms to spend their remaining years elsewhere is widespread. Many of them undoubtedly take up residence with their children who live in villages, towns, and cities. Such a migration of aged widowed females away from farms in larger numbers than is the case for aged widowed males probably accounts, for the most part, for the very high sex ratio of the aged farm population.

The concentration of males in the aged farm population of Louisiana is of great significance. This disproportionately large number of aged males exerts an important influence upon the nature of the problems confronting elderly farm people. Public Welfare and other governmental programs designed for aged farm people should take account of their distinctive balance between the sexes.

Racial Composition

A majority of the aged farm population of Louisiana in 1950 were native-white persons. Specifically, 59.1 per cent of them were classified in this category. Negroes comprised 38.9 per cent of the aged people in the farm population to rank as the second most important group. Foreign-born whites made up 1.9 per cent of the aged persons on farms, and "other races" accounted for only 0.1 per cent. Corresponding figures for the state's total aged population are 61.2, 34.3, 4.4, and 0.1 per cent respectively. (See Table II.) Native-born whites and foreign-born

TABLE II.—Persons 65 Years of Age and Over, by Race and Nativity, Louisiana, 1950

Area	Total		Native White		Foreign-born White		Negro		Other Races	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
State	178,510	100.0	109,385	61.2	7,810	4.4	61,180	34.3	135	.1
Rural-Farm	36,075	100.0	21,340	59.1	690	1.9	14,030	38.9	15	.1
Rural-Nonfarm	48,080	100.0	28,810	59.9	930	1.9	18,265	38.0	75	.2
Urban	94,355	100.0	59,235	62.8	6,190	6.5	28,885	30.6	45	.1
Baton Rouge	7,615	100.0	3,955	51.9	285	3.8	3,375	44.3	..	.
New Orleans	46,530	100.0	30,595	65.7	4,415	9.5	11,490	24.7	30	.1
Shreveport	12,390	100.0	6,680	53.9	410	3.3	5,300	42.8	..	.

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 53.

whites are relatively less important among the aged on farms than among old persons in the state's total population. Negroes, on the other hand, are relatively more numerous among the aged in the rural-farm areas than in the entire state. "Other races" constitute an insignificant part of both populations.

Native-born whites are relatively less important among aged persons on farms in Louisiana than in the state's urban population. This group made up 62.8 per cent of the aged in cities, whereas it accounted for only 59.1 per cent of the old persons on farms. However, aged Negroes are relatively more numerous among the aged on farms than in cities. The proportions were 38.9 and 30.6 per cents respectively. The relative importance of Negroes in the aged population of Louisiana's three large cities varied considerably. New Orleans has the highest proportion of native-born whites, the largest proportion of foreign-born whites, and the smallest proportion of Negroes among its aged population. Baton Rouge has the largest proportion of Negroes in the aged population, and Shreveport stands in an intermediate position in this respect.

The racial composition of elderly persons residing in rural-nonfarm territory closely paralleled that of oldsters living on farms.

Native whites are relatively most numerous among aged persons in the cities and least numerous among those on farms. Foreign-born whites are significantly more important among the aged in urban centers than in the rural-nonfarm and rural-farm areas. Negroes are relatively most numerous among aged persons in rural-farm territory and least important among the aged in the urban population. These differences are significant because they will in some measure condition the problems associated with aging in the three residential areas.

Marital Status

Marital status is an important indicator of the changes which have occurred in the pattern of family living of aged persons. These changes represent some of the most difficult problems which elderly people must confront. Especially is this true of older persons who have become widowed and dependent upon others for their subsistence and welfare. Figure 2 has been prepared to show the marital status of aged farm persons as compared to aged people in the state's population as a whole in 1950. Among aged men in the farm population, 74.7 per cent were married, 20.1 per cent were widowed, 4.6 per cent were single, and 0.6 per cent were divorced. A considerably larger proportion of the aged men on farms than of those in the total male population was married. The figures are 74.7 per cent married in the farm population and 68.3 per cent in the total male population. Also aged men in the farm population were widowed to a lesser extent than elderly men in the state, 20.1 per cent as compared to 24.3 per cent respectively. The same relationship obtains for white and nonwhite aged males in the rural-farm

MARITAL STATUS OF PERSONS 65 YEARS OF AGE AND OVER,
TOTAL AND RURAL-FARM POPULATIONS, BY SEX AND RACE, LOUISIANA, 1950

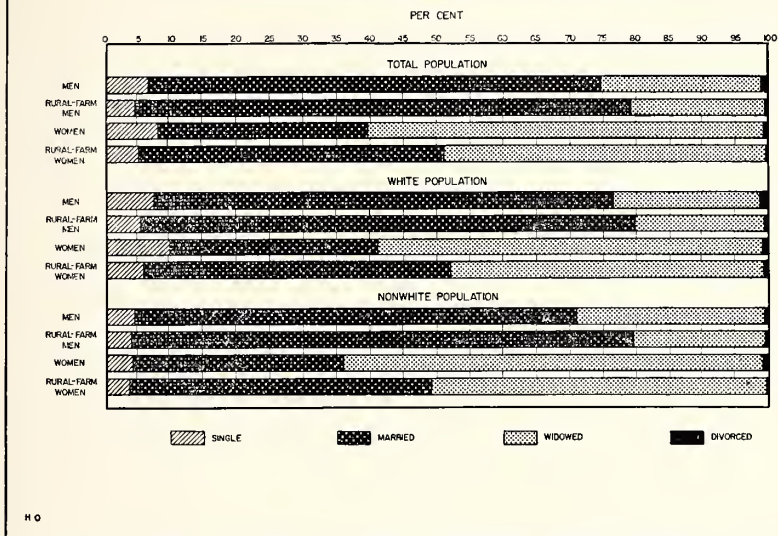


FIGURE 2.—Marital Status of Persons 65 Years of Age and Over, Total and Rural-Farm Populations, by Sex and Race, Louisiana, 1950, (Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 57.

areas. The differences were slightly greater, however, among aged rural-farm nonwhites than among aged farm white men.

In 1950 the aged male population residing in urban centers contained a much smaller proportion married and a considerably larger proportion widowed than the aged male population in the farm areas. (See Table III.) This same relationship holds in the three largest cities, Baton Rouge, New Orleans, and Shreveport. Furthermore, this same pattern prevails among aged white and nonwhite males. Among aged nonwhite men the proportion married in the urban population was very much smaller than in the farm population. Also the proportion widowed was much greater among urban aged nonwhite males than among this group in the farm population.

The rural-nonfarm aged men were found to be 69.2 per cent married and 24.4 per cent widowed in 1950. This means that they are less frequently married than aged men in the farm areas and slightly more often married than those in the state's total population. The urban aged men had a much lower proportion married and a much larger proportion widowed than did the rural-nonfarm aged men. The same pattern obtains for aged white men and aged nonwhite men.

The data further show that 4.6 per cent of the aged rural-farm men were single and 0.6 per cent of them were divorced in 1950. The figures

TABLE III.—Men 65 Years of Age and Over, by Marital Status, Louisiana, 1950

Area	Single		Married		Widowed		Divorced	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
(Total Population)								
<i>The State</i>	5,115	6.1	56,850	68.3	20,235	24.3	1,090	1.3
Rural-Farm	940	4.6	15,190	74.7	4,095	20.1	130	0.6
Rural-Nonfarm	1,220	5.2	16,375	69.2	5,780	24.4	290	1.2
Urban	2,955	7.5	25,285	64.4	10,360	26.4	670	1.7
Baton Rouge	175	5.6	2,100	67.1	815	26.0	40	1.3
New Orleans	1,810	9.8	11,365	61.3	4,975	26.9	365	2.0
Shreveport	275	4.9	3,781	67.1	1,480	26.3	95	1.7
(White Population)								
<i>The State</i>	3,825	7.1	37,175	69.1	11,915	22.2	840	1.6
Rural-Farm	615	5.1	9,055	74.1	2,460	20.1	85	0.7
Rural-Nonfarm	880	6.0	10,430	70.5	3,255	22.0	220	1.5
Urban	2,330	8.7	17,690	66.1	6,200	23.2	535	2.0
Baton Rouge	105	6.5	1,155	71.5	330	20.4	25	1.6
New Orleans	1,540	11.1	8,545	61.9	3,430	24.8	300	2.2
Shreveport	225	7.1	2,205	69.7	665	21.0	70	2.2
(Nonwhite Population)								
<i>The State</i>	1,290	4.4	19,675	66.6	8,320	28.2	250	0.8
Rural-Farm	325	4.0	6,135	75.3	1,635	20.1	45	0.6
Rural-Nonfarm	340	3.8	5,945	67.0	2,525	28.4	70	0.8
Urban	625	5.0	7,595	60.7	4,160	33.2	135	1.1
Baton Rouge	70	4.6	945	62.4	485	32.0	15	1.0
New Orleans	270	5.7	2,820	60.0	1,545	32.9	65	1.4
Shreveport	50	2.0	1,575	63.9	815	33.1	25	1.0

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. 11, Part 18, Table 57.

for the state's aged men were 6.1 per cent and 1.3 per cent respectively. Of aged men in all residential categories, the urban population contained the largest proportion classified as single. It also included the highest proportion which was divorced, even though in all cases the figures are comparatively small.

Nonwhite aged men have a relatively smaller number of single persons than aged white men. This obtained among the total, rural-farm, rural-nonfarm and urban population in 1950. The proportion divorced was slightly less among nonwhite than among white aged men.

These data reveal that the aged man, whether he is white or non-white, rural-farm, rural-nonfarm, or urban, is still living predominantly in a married state in his advanced years. Approximately two-thirds of them were so classified in 1950. However, significant proportions of them are widowed. The data reveal that roughly one-fourth of them were living alone, having been preceded in death by their wives. Relatively small proportions of them were still single and only an insignificant number were divorced.

The marital status of aged rural-farm women, and women in general, is quite different from that of men. Figure 2 reveals that the majority of the aged women are living in a widowed status. For the state as a whole, 59.4 per cent of the women 65 years of age and over

had experienced the loss of their husbands. The proportion of aged women who are widowed is lower among those who live on farms. In fact, only 48.6 per cent were reported as widowed in 1950. The rural-nonfarm aged women had a higher proportion widowed than the aged farm women. However, by far the largest proportions of aged women in this category were found in the urban population. In fact, 62.9 per cent of the aged women in cities were widows. The proportion is equally as high among the aged women in the state's three largest cities, Baton Rouge, New Orleans, and Shreveport.

The residential pattern with respect to the proportion of aged women married is the converse of that for the proportion widowed. (See Table IV.) The rural-farm aged women had the largest proportion married (46.1 per cent), the rural-nonfarm group recorded the next highest proportion married (36.3 per cent), and the urban places had the lowest percentage in that category. In fact, only about one-fourth of the aged urban women were married in 1950. The state's largest cities had a similarly low proportion of married persons among their aged female population.

The rural-farm aged women also had a relatively low proportion of persons classified as single (4.9 per cent), although the smallest proportion in this status was found in the rural-nonfarm group (4.4 per

TABLE IV.—Women 65 Years of Age and Over, by Marital Status, Louisiana, 1950

Area	Single		Married		Widowed		Divorced	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
(Total Population)								
<i>The State</i>	7,485	7.9	30,365	31.9	56,590	59.4	780	.8
Rural-Farm	770	4.9	7,245	46.1	7,640	48.6	65	.4
Rural-Nonfarm	1,085	4.4	8,855	36.3	14,300	58.6	175	.7
Urban	5,630	10.2	14,265	25.9	34,650	62.9	540	1.0
Baton Rouge	280	6.2	1,330	29.7	2,810	62.7	65	1.4
New Orleans	3,830	13.7	6,640	23.7	17,280	61.7	265	.9
Shreveport	320	4.8	1,745	25.8	4,605	68.1	90	1.3
(White Population)								
<i>The State</i>	6,245	9.9	20,260	31.9	36,400	57.4	535	.8
Rural-Farm	570	5.8	4,535	46.2	4,655	47.4	55	.6
Rural-Nonfarm	815	5.5	5,485	36.7	8,545	57.1	110	.7
Urban	4,860	12.6	10,240	26.5	23,200	60.0	370	.9
Baton Rouge	205	7.8	765	29.2	1,610	61.3	45	1.7
New Orleans	3,365	15.9	5,180	24.4	12,455	58.8	195	.9
Shreveport	255	6.5	1,040	26.5	2,570	65.5	60	1.5
(Nonwhite Population)								
<i>The State</i>	1,240	3.9	10,105	31.8	20,190	63.5	245	.8
Rural-Farm	200	3.4	2,710	45.9	2,985	50.5	10	.2
Rural-Nonfarm	270	2.9	3,370	35.6	5,755	60.8	65	.7
Urban	770	4.7	4,025	24.5	11,450	69.8	170	1.0
Baton Rouge	75	4.0	565	30.4	1,200	64.5	20	1.1
New Orleans	465	6.8	1,460	21.4	4,825	70.8	70	1.0
Shreveport	65	2.3	705	24.8	2,035	71.8	30	1.1

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 57.

cent.) The urban aged women were single to a much larger extent than those in farm or nonfarm areas. In fact, one-tenth of the aged women in urban places in 1950 were still in a single marital status. However, great variations existed among the three largest cities. New Orleans had a very high proportion of aged women classified as single (13.7 per cent), and Baton Rouge and Shreveport had comparatively low proportions of their aged women in this category, 6.2 per cent and 4.8 per cent respectively.

The divorced were proportionately least numerous among aged rural-farm women and most numerous among urban aged women, the percentages being 0.4 and 1.0 respectively. The rural-nonfarm aged women ranked intermediate in the proportion divorced (0.7 per cent).

A study of the marital status of aged women by race shows that generally the same relationships prevail among whites and nonwhites as described in the preceding paragraphs for the total population. The main differences are that the nonwhite aged women have a substantially larger proportion classified as widowed and a significantly smaller proportion in the single category. For the state, 63.5 per cent of the nonwhite aged women were widowed and 57.4 per cent of the white aged women were in this category. Only 3.9 per cent of the nonwhite aged women were single as compared to 9.9 per cent of the aged white women. The proportions which were married and divorced were approximately the same.

The high proportion of aged farm women who are married and the low proportion who are widowed tends to support the inference drawn in the analysis of sex composition. In that context it was suggested that the selective migration of aged widows from farms to nonfarm and urban territory probably contributed to the high masculinity of the aged farm population. Such a movement would also result in the high proportion of aged women in the married state and the low proportion classified as widowed. This migration, of course, would have the reverse effect upon the marital structure of the communities receiving these aged migrant widows, thus contributing further to the residential differentials. The high sex ratio in farm areas would also provide greater opportunities for remarriage among aged female widows than exist in other residential populations.

Relationship to Head of Household

The relationship of the aged person to the head of the household in which he resides is suggestive of the adjustment which he has had to make as a result of his advanced years. Figure 3 depicts the relationship of the aged persons in the rural-farm and total population to the head of the households in which they reside. This chart indicates that in 1950 the great majority of the farm men 65 years of age and over were heads of the household in which they lived. In fact, 83.4 per cent of them were so classified. Nevertheless, 9.9 per cent of the aged farm men were parents

PERSONS 65 YEARS OF AGE AND OVER,
BY RELATIONSHIP TO HEAD OF HOUSEHOLD, LOUISIANA, 1950

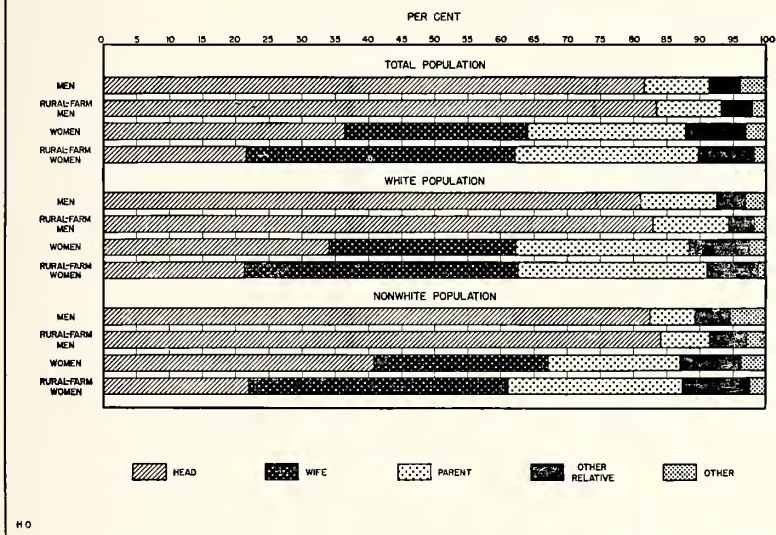


FIGURE 3.—Persons 65 Years of Age and Over, by Relationship to the Head of the Household, Total and Rural-Farm Populations, by Sex and Race, Louisiana, 1950. (Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 58.)

of the head of the household, 4.6 per cent were other relatives of the head, 1.9 per cent were lodgers, and insignificant proportions were children of the head and resident employees (0.1 per cent in both categories). Aged persons in the state generally had a slightly lower proportion (81.6 per cent) classified as head of households and a considerably larger proportion (3.7 per cent) in the lodger category.

The urban aged male population recorded the smallest proportion which was the head of the household (77.8 per cent). (See Table V.) This residential group also had the highest proportion of its aged men classified as parents of the head of the household (11.2 per cent), as other relatives of the head (5.4 per cent), and as lodgers (5.4 per cent). On the other hand, aged men in the nonfarm population had the largest proportion (86.1 per cent) classified as heads of households and the lowest proportion who were living with other relatives (3.6 per cent).

Approximately the same relationship obtained for white and nonwhite aged men as described above for the total aged population. The most significant difference seems to be in the proportion classified as parent of the head of the household. In farm areas the figure for the aged white men was 11.5 per cent as compared to 7.5 per cent for the aged nonwhite men. From this differential it would appear that among

TABLE V.—Men 65 Years of Age and Over, by Relationship to Head of Household, Louisiana, 1950

Area	Head	Child	Parent	Other Relative	Lodger	Resident Employee
<i>Percentages</i>						
<i>(Total Population)</i>						
<i>The State</i>	81.6	.1	9.8	4.7	3.7	.1
Rural-Farm	83.4	.1	9.9	4.6	1.9	.1
Rural-Nonfarm	86.1	.1	7.5	3.6	2.6	.1
Urban	77.8	.1	11.2	5.4	5.4	.1
Baton Rouge	78.7	.2	10.5	5.4	5.2	.
New Orleans	75.7	.1	12.1	6.4	5.6	.1
Shreveport	79.0	.2	10.6	4.8	5.2	.2
<i>(White Population)</i>						
<i>The State</i>	81.0	.2	11.6	4.3	2.8	.1
Rural-Farm	82.9	.2	11.5	3.9	1.4	.1
Rural-Nonfarm	85.0	.2	9.3	3.4	2.0	.1
Urban	77.8	.1	12.9	5.1	4.0	.1
Baton Rouge	77.6	.	14.4	3.8	4.2	.
New Orleans	75.5	.1	13.3	6.5	4.5	.1
Shreveport	80.1	.3	12.3	3.2	4.1	.
<i>(Nonwhite Population)</i>						
<i>The State</i>	82.5	.1	6.8	5.2	5.3	.1
Rural-Farm	84.1	.1	7.5	5.5	2.7	.1
Rural-Nonfarm	88.0	.1	4.6	3.8	3.5	.
Urban	77.7	.1	7.8	6.1	8.2	.1
Baton Rouge	79.9	.3	6.4	7.0	6.4	.
New Orleans	76.1	.	8.7	6.4	8.7	.1
Shreveport	77.6	.	8.6	6.7	6.7	.4

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. 11, Part 18, Table 58.

farm people aged white males are much more likely to live with their adult children than is the case for nonwhite male oldsters.

The situation among aged farm women in regard to the relationship to the head of the household is considerably different from that of the males, as is to be expected. Louisiana's farm women 65 years of age and over were classified as follows in 1950: head of the household, 21.6 per cent; wife of the head, 40.4 per cent; child of the head, 0.2 per cent; parent of the head, 27.8 per cent; other relative, 8.5 per cent; lodger, 1.4 per cent; and resident employee, 0.1 per cent. Aged farm women, as compared with those in other residential categories, least often served as heads of households but most often were wives of heads. This pattern is to be expected in view of the high proportion of them who are married.

It is interesting to note that the aged rural-nonfarm women were heads of households to a larger degree than aged women in the other residential areas. In fact, 41.3 per cent of them were in this category. (See Table VI.) This group also had the smallest proportion of aged women living with their children and classified as parents of the head (18.1 per cent). Significantly, the smallest proportions which were classified as wives (21.6 per cent) and as lodgers (3.6 per cent) were

TABLE VI.—Women 65 years of Age and Over, by Relationship to Head of Household, Louisiana, 1950

Area	Head	Wife	Child	Parent	Other Relative	Lodger	Resident Employee
<i>Percentages</i>							
(Total Population)							
<i>The State</i>	36.4	27.5	.2	24.1	9.0	2.6	.2
Rural-Farm	21.6	40.4	.2	27.8	8.5	1.4	.1
Rural-Nonfarm	41.3	32.3	.3	18.1	6.5	1.4	.1
Urban	38.5	21.6	.1	25.7	10.3	3.6	.2
Baton Rouge	36.2	24.8	.2	28.2	7.6	2.8	.2
New Orleans	34.8	19.2	.1	28.1	13.4	4.1	.3
Shreveport	39.1	22.1	.2	25.9	8.3	4.1	.3
(White Population)							
<i>The State</i>	34.1	28.1	.1	26.2	9.0	2.3	.2
Rural-Farm	21.3	41.2	.2	28.6	7.6	1.0	.1
Rural-Nonfarm	39.1	33.0	.2	20.8	5.7	1.1	.1
Urban	35.5	22.7	.1	27.7	10.7	3.1	.2
Baton Rouge	33.3	24.3	.4	34.5	5.1	2.2	.2
New Orleans	32.3	20.4	.1	29.8	13.7	3.5	.2
Shreveport	35.8	23.9	.1	28.1	8.0	3.7	.4
(Nonwhite Population)							
<i>The State</i>	40.8	26.3	.3	20.0	9.1	3.3	.2
Rural-Farm	21.9	39.1	.5	26.3	10.2	2.0	.2
Rural-Nonfarm	44.9	31.1	.3	13.9	7.9	1.8	.1
Urban	45.4	18.9	.2	21.2	9.3	4.7	.3
Baton Rouge	40.2	25.5	.	19.6	10.9	3.5	.3
New Orleans	42.2	15.4	.2	22.9	12.6	6.2	.5
Shreveport	43.4	19.6	.4	22.9	8.8	4.7	.2

Source: United States Census, 1950, Louisiana, "Characteristics of the Population," Vol. 11, Part 18, Table 58.

found among aged women in cities. The aged women on farms were living with their children to a greater extent than aged women in either the rural-nonfarm or urban places. In fact, more than one fourth of them were in this status (27.8 per cent).

In considering the relationship of aged farm women to the head of the household in the two races, some significant differences are noted. The aged nonwhite women in the rural-farm population were classified in larger proportion (10.2 per cent as compared to 7.6 per cent) as other relatives of the head than their counterparts in the white population. As was the case with males, aged nonwhite farm females are somewhat less likely to be living with their adult children than are their white counterparts.

Educational Status

In general the aged persons of the state are a poorly educated group of citizens. This is not surprising because their attainments represent the product of our educational system of forty or more years ago. As the new generations move into the advanced years of life, this low educational status will undoubtedly be improved, reflecting the achievements of our modern school program. Figure 4 presents the educational status

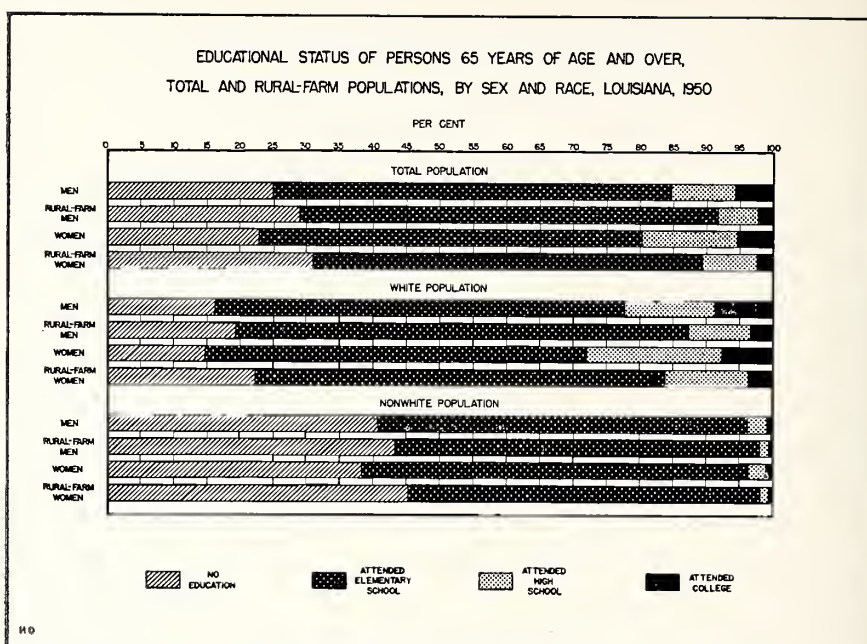


FIGURE 4.—Educational Status of Persons 65 Years of Age and Over, Total and Rural-Farm Populations, by Sex and Race, Louisiana, 1950. (Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 65.)

of aged persons in the farm and the total populations by sex and race. Readily evident is the large proportion of aged persons who have had absolutely no formal education. Among aged farm men, 28.9 per cent had never attended school and 62.7 per cent had attended only elementary school. The aged farm men who had attended high school accounted for only 6.2 per cent, and those who had attended college made up only 2.2 per cent. Generally, the data show that aged farm men have a lower educational status than aged men in the state's total population. The former included the lowest proportions that had attended high school and college of all of the residential areas. The aged men on farms also had a very large proportion that had received no schooling, being surpassed in this measurement only slightly by those aged men living in rural-nonfarm areas (28.9 per cent as compared to 31.7 per cent). (See Table VII). Significantly larger proportions of the aged men in urban places than in the other residential groups had attended high school and college.

A consideration of the educational status of aged men by race in 1950 reveals substantially superior attainment on the part of whites as compared to nonwhites. In the farm population, only 19.3 per cent of the aged white men had no education as compared to 43.3 per cent of

TABLE VII.—Persons 65 Years of Age and Over, by Educational Status, Louisiana, 1950

Area	Males			Females				
	No Education	Attended Elementary School	Attended High School	Attended College	No Education	Attended Elementary School	Attended High School	Attended College
Percentages								
(Total Population)								
<i>The State</i>	24.9	59.4	9.9	5.8	22.7	57.5	14.4	5.4
Rural-Farm	28.9	62.7	6.2	2.2	30.9	58.3	8.4	2.4
Rural-Nonfarm	31.7	57.6	7.0	3.7	32.5	55.3	8.9	3.3
Urban	18.7	58.7	13.6	9.0	16.0	58.2	18.6	7.2
Baton Rouge	21.3	57.1	12.9	8.7	20.6	49.1	20.4	9.9
New Orleans	11.6	64.6	14.1	9.7	9.7	66.3	18.1	5.8
Shreveport	20.9	55.0	15.4	8.7	16.9	53.8	19.9	9.4
(White Population)								
<i>The State</i>	16.1	61.6	13.7	8.6	14.8	57.2	20.3	7.7
Rural-Farm	19.3	68.0	9.3	3.4	22.2	61.5	12.6	3.7
Rural-Nonfarm	22.2	62.3	9.8	5.7	23.5	57.6	13.7	3.8
Urban	11.1	58.2	18.1	12.6	9.5	56.1	24.7	9.7
Baton Rouge	6.8	54.6	22.7	15.9	6.7	45.6	32.2	15.5
New Orleans	8.3	62.4	17.0	12.3	6.5	64.1	22.3	7.1
Shreveport	5.2	55.2	25.1	14.5	2.5	49.2	32.3	16.0
(Nonwhite Population)								
<i>The State</i>	40.8	55.4	3.0	0.8	38.3	57.9	2.9	0.9
Rural-Farm	43.3	54.7	1.6	0.4	45.2	53.0	1.4	0.4
Rural-Nonfarm	47.4	49.7	2.2	0.7	46.6	51.2	1.7	0.5
Urban	34.5	59.8	4.3	1.4	31.1	63.5	4.2	1.2
Baton Rouge	36.8	59.7	2.4	1.1	40.5	53.9	3.6	2.0
New Orleans	21.2	71.3	5.4	2.1	19.7	73.4	5.3	1.6
Shreveport	40.9	55.0	2.9	1.2	36.5	60.0	2.9	0.6

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 65.

the nonwhites. Also, very small proportions of the aged rural-farm nonwhites had attended high school and college, 1.6 per cent and 0.4 per cent, respectively. Corresponding figures for the aged white men on farms are 9.3 per cent and 3.4 per cent. The differentials previously noted among the total farm, nonfarm, and urban aged men also prevail among both whites and nonwhites. In both races, the nonfarm population had the highest proportions reporting no formal schooling. The aged urban males among both races had the greatest relative numbers which had attended high school and college. In all residential categories, the educational status of the white was superior to that of the nonwhite aged men.

Although it is usually believed that the philosophy of education of a half century ago held that the men should be educated in preference to the women, the data on educational attainment of aged women do not entirely support this idea. Table VII indicates that aged women are a better educated group than aged men in the total and urban populations. In the rural-farm and rural-nonfarm populations, however, larger proportions of aged women have had no schooling and slightly smaller percentages have attended high school. This indicates that only in rural areas did the men receive educational opportunities in preference to the women.

Residential differentials in education for females are generally similar to those of males. In 1950, of all aged farm women, 30.9 per cent reported no schooling, 58.3 per cent had attended elementary school, 8.4 per cent had gone to high school, and 2.4 per cent had attended college. This means that only one in ten had advanced beyond the elementary grades. Aged women in the urban places, and especially in the large metropolitan centers, had the highest educational attainment of any residential group.

An analysis of educational status of aged women by race shows the same differential in schooling which prevailed among the aged males. Aged nonwhite women have lower educational achievements than aged white women. The rural-farm white and nonwhite aged women have larger proportions with no schooling than any other group except aged women in the nonfarm population. Aged urban white and nonwhite women both reported the highest educational attainment. These same patterns were found to exist among aged white and aged nonwhite males.

Employment Status

The majority of the persons 65 years of age and over in Louisiana are no longer part of the labor force. In fact, for the total population, 68.7 per cent of the aged men and 94.8 per cent of the aged women were not part of the labor force in 1950. A slightly smaller proportion of the aged rural-farm men was not included in the labor force (54.6 per cent); however, 96.0 per cent of the aged rural-farm women were not in the labor force. The rural-farm population of all residential areas had the

smallest relative number of aged men not part of the labor force. Among aged rural-nonfarm men, 81.9 per cent were no longer in the working population, and 68.2 per cent of the aged urban men were in this category. In all residential areas, the proportion of aged women not part of the labor force is exceedingly high. In fact, 96.5 per cent of the aged rural-nonfarm women and 93.7 per cent of the aged urban women were in this classification.

The relatively high proportions of both aged males and aged females in rural-nonfarm areas not in the labor force support the thesis inferred from other data that small towns and villages are serving as havens of refuge for the retired. Perhaps rural-nonfarm territory is the frequent destination of retired people leaving both farms and cities.

A similar relationship prevails when employment status is examined by race. Among whites, 66.8 per cent of the aged men and 95.0 per cent of the aged women were not in the working force in 1950. Comparable figures for aged rural-farm whites were 58.6 and 96.6 per cent respectively. Among nonwhites, 71.5 per cent of the aged men and 94.4 per cent of the aged women were not included in the labor force. In the rural-farm population, 48.5 per cent of the aged nonwhite men and 94.8 per cent of the aged nonwhite women were in this category.

Even though only small proportions of the aged persons of the state are still part of the labor force, those who are in that category manage to retain their employment to a great extent. (See Table VIII.) For instance, 97.1 per cent of the aged men in the labor force in 1950 had jobs. This proportion was even higher among aged rural-farm men (99.6 per cent). The urban places had the lowest proportion employed (95.4 per cent) and consequently the largest proportion unemployed. Approximately the same employment statuses as described above for the aged male population obtain when the analysis is made by race. Aged nonwhite males had a slightly lower proportion employed and consequently a slightly higher proportion unemployed in each of the residential categories.

The small number of aged women who are still part of the labor force also are able to maintain their employment to a high degree. In fact, 97.5 per cent of the aged women in the state in 1950 who were part of the labor force had jobs. This proportion was highest among aged rural-farm women (99.2 per cent) and lowest among aged urban women (96.8 per cent). A comparable figure for the rural-nonfarm aged women was 98.8 per cent. The employment situation of aged women analyzed by race reveals that both aged white and nonwhites have high records for employment. Among aged white women, 97.7 per cent were employed as compared to 96.6 per cent among aged nonwhite women. A similarly high proportion was employed among aged rural-farm white women (98.5 per cent), and all of the aged nonwhite women in the rural-farm labor force had jobs in 1950.

TABLE VIII.—Persons 65 Years of Age and Over in the Civilian Labor Force, by Employment Status, Louisiana, 1950

Areas	Males				Females			
	Employed		Unemployed		Employed		Unemployed	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
<i>The State</i>	26,215		750	(Total Population) 2.9	4,810	97.5	125	2.5
Rural-Farm	9,220	97.1	35	.4	630	99.2	5	.8
Rural-Nonfarm	4,505	99.6	135	3.0	845	98.8	10	1.2
Urban	12,490	97.0	580	4.6	3,335	96.8	110	3.2
Baton Rouge	935	95.4	55	5.8	260	96.3	10	3.7
New Orleans	6,600	94.2	320	4.8	1,795	95.0	95	5.0
Shreveport	1,820	95.2	30	1.6	450	98.9	5	1.1
		98.4						
<i>The State</i>	17,800		450	(White Population) 2.5	3,090	97.9	65	2.1
Rural-Farm	5,040	97.5	10	.2	325	98.5	5	1.5
Rural-Nonfarm	3,005	99.8	40	1.3	425	100.0	..	..
Urban	9,755	95.9	400	4.1	2,340	97.5	60	2.5
Baton Rouge	580	99.1	5	.9	165	100.0	..	..
New Orleans	5,515	95.4	255	4.6	1,350	96.1	55	3.9
Shreveport	1,125	99.1	10	.9	235	97.9	5	2.1
<i>The State</i>	8,415		300	(Nonwhite Population) 3.6	1,720	96.6	60	3.4
Rural-Farm	4,180	96.4	25	.6	305	100.0	..	..
Rural-Nonfarm	1,500	99.4	95	6.3	420	97.7	10	2.3
Urban	2,735	93.7	180	6.6	995	95.2	50	4.8
Baton Rouge	375	86.7	50	13.3	95	90.5	10	9.5
New Orleans	1,085	94.0	65	6.0	445	91.8	40	8.2
Shreveport	695	97.1	20	2.9	215	100.0	..	..

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 66.

Most of the problems related to aged persons center around those people who are no longer part of the labor force. For the most part, they represent individuals who have become dependent upon society or relatives for their subsistence and support. Information presented in Figure 5 shows the status of aged farm persons in Louisiana in 1950. Comparison is made with the aged in the total population of the state. Of the 11,110 aged rural-farm men not in the labor force, by far the largest proportion (78.9 per cent) were classified as unable to work. The remainder had the following statuses: other and not reported, 19.8 per cent; and keeping house, 1.3 per cent. Comparable figures for the state's aged males are 69.6 per cent, 26.6 per cent, and 1.7 per cent respectively. In the state's total aged male population, 2.1 per cent were inmates of institutions. No inmates of such institutions are classified as rural-farm residents.

It is of significance that the farm areas, of all of the residential categories, had the largest proportion of aged males classified as unable to work. (See Table IX.) This figure was 78.9 per cent. Among aged rural-nonfarm men, 75.5 per cent were unable to work as compared to only 61.6 per cent among aged urban men. The cities of Baton Rouge

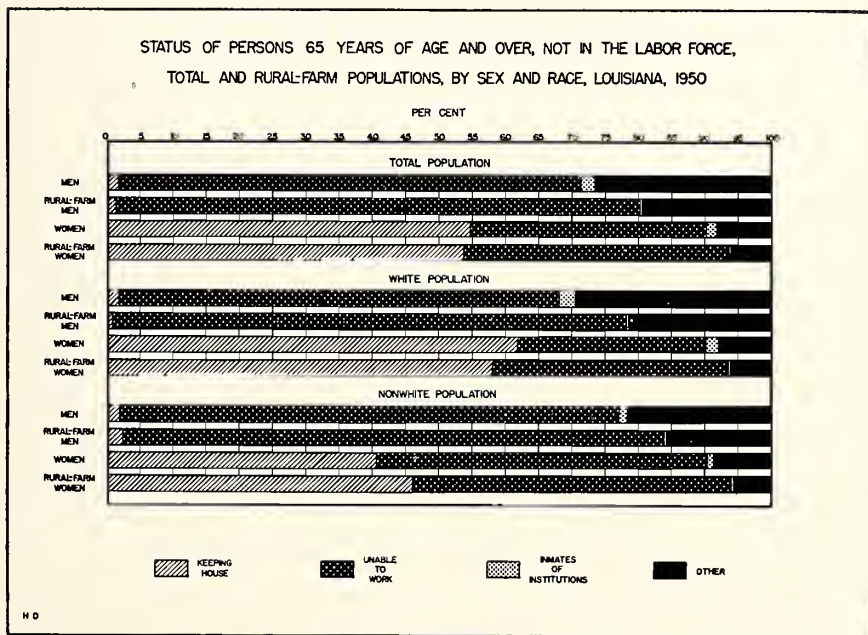


FIGURE 5.—Status of Persons 65 Years of Age and Over, Not in the Labor Force, Total and Rural-Farm Populations, by Sex and Race, Louisiana, 1950. (Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 68.)

TABLE IX.—Men 65 Years of Age and Over Not in the Labor Force, by Status, 1950

Area	Total Number	Keeping House		Unable to Work		Inmates of Institutions		Other and Not Reported	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
(Total Population)									
<i>The State</i>	57,045	990	1.7	39,725	69.6	1,165	2.1	15,165	26.6
Rural-Farm	11,110	145	1.3	8,765	78.9	...	..	2,200	19.8
Rural-Nonfarm	19,160	365	1.9	14,455	75.5	290	1.5	4,050	21.1
Urban	26,775	480	1.8	16,505	61.6	875	3.3	8,915	33.3
Baton Rouge	2,175	50	2.3	1,255	57.7	10	.5	860	39.5
New Orleans	11,910	215	1.8	6,720	56.4	345	2.9	4,630	38.9
Shreveport	3,805	50	1.3	2,870	75.4	70	1.9	815	21.4
(White Population)									
<i>The State</i>	35,935	615	1.7	23,840	66.3	890	2.5	10,590	29.5
Rural-Farm	7,160	55	.8	5,545	77.4	...	..	1,560	21.8
Rural-Nonfarm	11,780	250	2.1	8,620	73.2	220	1.9	2,690	22.8
Urban	16,995	310	1.8	9,675	56.9	670	4.0	6,340	37.3
Baton Rouge	1,035	15	1.5	490	47.3	10	1.0	520	50.2
New Orleans	8,295	160	1.9	4,380	52.8	290	3.5	3,465	41.8
Shreveport	2,040	25	1.2	1,385	67.9	60	2.9	570	28.0
(Nonwhite Population)									
<i>The State</i>	21,110	375	1.8	15,885	75.2	275	1.3	4,575	21.7
Rural-Farm	3,950	90	2.3	3,220	81.5	...	..	640	16.2
Rural-Nonfarm	7,380	115	1.6	5,835	79.1	70	.9	1,360	18.4
Urban	9,780	170	1.7	6,830	69.9	205	2.1	2,575	26.3
Baton Rouge	1,140	35	3.1	765	67.1	...	..	340	29.8
New Orleans	3,615	55	1.5	2,340	64.8	55	1.5	1,165	32.2
Shreveport	1,765	25	1.4	1,485	84.1	10	.6	245	13.9

Source: United States Census, 1950, Louisiana, "Characteristics of the Population," Vol. II, Part 18, Table 68.

and New Orleans had low proportions of their aged men in this category, 57.7 and 56.4 per cent respectively. On the other hand, a very large proportion (75.4 per cent) of the aged men in Shreveport were unable to work. Relatively small proportions of the aged men in all residential areas were keeping house. The rural-farm area had the smallest proportion of its aged men in this category (1.3 per cent) as would be expected from their marital status. Among aged men in rural-nonfarm areas, 1.9 per cent were keeping house, and in urban areas, 1.8 per cent were so classified. The largest relative number of aged men who were keeping house was found in Baton Rouge, in which 2.3 per cent were so occupied in 1950.

An analysis of the status of aged men who were no longer part of the labor force, by race, shows that the majority of both aged white and nonwhite men were unable to work. The proportion in this category, however, was somewhat higher among nonwhite aged men than among whites in a similar age group, 75.2 per cent as compared to 66.3 per cent. This same relationship held for the rural-farm aged male population except that larger proportions in both races were unable to work. Among white aged men on farms, 77.4 per cent were unable to work as compared to 81.5 per cent among their nonwhite counterparts. For the state as a whole, a larger proportion of aged white men (2.5 per cent) were inmates of institutions than of aged nonwhite men (1.3 per cent). In the other statuses, the proportions among white and nonwhite aged males were about the same as those prevailing among the total aged male population.

As is to be expected, the status of aged women who are not part of the labor force is considerably different from that of aged men. The majority of this group were classified as keeping house in 1950, whereas the majority of the aged men were listed as unable to work. (See Table X.) In the total population, 54.7 per cent of the aged women were keeping house as compared to 53.6 per cent in the farm population. Even though the majority of the aged women were classified as keeping house, a status which does not carry problem connotations, a very large proportion of them were listed as unable to work. In fact, 35.5 per cent of the aged women were listed as unable to work in 1950. The figure among the aged women on farms was significantly higher than that for the state, amounting to 40.0 per cent. Only aged women in rural-nonfarm areas had a higher proportion classified as unable to work than in the farm population, and the difference was very small (40.3 per cent compared to 40.0 per cent). In the state, 1.7 per cent of the aged women, amounting to 1,565 persons, were inmates of institutions.

The aged urban female population included higher proportions keeping house than the farm population. In fact, 56.2 per cent of the aged women in cities were occupied in this task in 1950. The aged

TABLE X.—Women 65 Years of Age and Over Not in the Labor Force, by Status, 1950

Area	Total Number	Keeping House		Unable to Work		Inmates of Institutions		Other and Not Reported	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
<i>The State</i>	90,285	49,380	54.7	32,045	35.5	1,565	1.7	7,295	8.1
Rural-Farm	15,085	8,090	53.6	6,025	40.0	...	..	970	6.4
Rural-Nonfarm	23,560	12,260	52.0	9,490	40.3	325	1.4	1,485	6.3
Urban	51,640	29,030	56.2	16,530	32.0	1,240	2.4	4,840	9.4
Baton Rouge	4,215	2,335	55.4	1,370	32.5	...	..	510	12.1
New Orleans	26,125	14,770	56.5	7,790	29.8	645	2.5	2,920	11.2
Shreveport	6,305	3,235	51.3	2,530	40.1	100	1.6	440	7.0
(Total Population)									
<i>The State</i>	60,285	37,185	61.7	17,135	28.4	1,275	2.1	4,690	7.8
Rural-Farm	9,485	5,510	58.1	3,345	35.3	...	..	630	6.6
Rural-Nonfarm	14,530	8,510	58.5	4,950	34.1	245	1.7	825	5.7
Urban	36,270	23,165	63.9	8,840	24.4	1,030	2.8	3,235	8.9
Baton Rouge	2,460	1,590	64.6	545	22.2	...	..	325	13.2
New Orleans	19,790	12,445	62.9	4,800	24.3	580	2.9	1,965	9.9
Shreveport	3,685	2,425	65.8	890	24.1	80	2.2	290	7.9
(Nonwhite Population)									
<i>The State</i>	30,000	12,195	40.6	14,910	49.7	290	1.0	2,605	8.7
Rural-Farm	5,600	2,580	46.1	2,680	47.8	...	..	340	6.1
Rural-Nonfarm	9,030	3,750	41.5	4,540	50.3	80	.9	660	7.3
Urban	15,370	5,865	38.2	7,690	50.0	210	1.4	1,605	10.4
Baton Rouge	1,755	745	42.5	825	47.0	...	..	185	10.5
New Orleans	6,335	2,325	36.7	2,990	47.2	65	1.0	955	15.1
Shreveport	2,620	810	30.9	1,640	62.6	20	.8	150	5.7

Source: United States Census, 1950, Louisiana, "Characteristics of the Population," Vol. 11, Part 18, Table 68.

urban female population also had the smallest relative numbers classified as unable to work. Only 32.0 per cent of them were in this category. However, 2.4 per cent of them were inmates of institutions. These data indicate that problems relating to incapacitated aged women are greater in the farm areas than in the cities.

An analysis of the status of aged women who were not part of the labor force, by race, shows some significant differences. Apparently problems centering around disability to the extent that the individual is unable to work are much greater among aged nonwhite women than among aged white women. This is reflected in the proportion of aged women who were keeping house, a normal or usual status for women. Among aged white women in the state, 61.7 per cent were keeping house in 1950 as compared to 40.6 per cent among nonwhites. Conversely, nearly twice as many aged nonwhite women were unable to work as aged white women, 49.7 per cent compared to 28.4 per cent respectively. The same situation, except to a lesser extent, obtains when aged white and nonwhite women in the farm population are compared. The proportions keeping house in the farm population were 58.1 per cent among aged white women and 46.1 per cent among aged nonwhite women. A total of 35.3 per cent of the aged white farm women were unable to work as compared to 47.8 per cent among nonwhite farm women.

It is of interest to note that approximately one-half of the aged nonwhite women in the cities of the state were classified as unable to work. The data show that 50.0 per cent of the aged nonwhite women in the urban population, 47.0 per cent in Baton Rouge, 47.2 per cent in New Orleans, and 62.6 per cent in Shreveport were disabled to the extent that they were unable to work in 1950. The proportion in the cities classified as unable to work among aged white women was about half as much as among nonwhites. In fact, 24.4 per cent of the total aged urban white women, 22.2 per cent of those in Baton Rouge, 24.3 per cent in New Orleans, and 24.1 per cent in Shreveport were so classified.

These data indicate that problems relating to disabled aged women are more prevalent among rural-farm people and among nonwhites than among the other people in the population. Aged nonwhite women in cities also reported a very high proportion of disabled persons in 1950.

Income Status

Aged persons on farms have the lowest median income among the aged of any of the residential areas. They had a median income of \$757 in 1950 compared to \$849 for aged men in the urban and rural-nonfarm areas. In New Orleans, aged men had a median income of \$1,027, the highest figure for any residential area. The median income of all aged men in the state was \$823.

Aged farm women had a lower median income in 1950 than any comparable group in the state. They received only \$692 as their median income in that year. Aged women in New Orleans had the highest median income (\$733), and those in the urban and rural-nonfarm areas ranked in the intermediate position with a median income of \$717. The median income of aged women in the state as a whole was \$712.

These figures show that generally aged women have lower median incomes than aged men and that aged persons in the rural-farm population have lower incomes than those in the other residential areas.

In studying the distribution of income to aged persons, significant differences are revealed between aged men on farms and aged men in the other residential areas. (See Table XI.) The aged men on farms include larger proportions with low incomes and smaller proportions with high incomes than aged men in other areas. Among aged men on farms in 1950, 9.8 per cent had no incomes; 16.5 per cent had incomes between \$1 and \$499 or sustained a loss; 55.7 per cent earned \$500 to \$999; 8.7 per cent received \$1,000 to \$1,499; 2.8 per cent had incomes of \$1,500 to \$1,999; and only 6.5 per cent had incomes over \$2,000. In the urban and rural-nonfarm areas much larger proportions of aged men received higher incomes. In New Orleans, about one-fourth of the aged men received a median income of over \$2,000 per year.

The distribution of income among aged women is somewhat different from that of aged men. For one thing, a much larger proportion of aged women than of aged men had no income. In fact, roughly one-third of the former had no income in 1950 as compared to one-tenth of the latter. Furthermore, there was not so much variation in the pattern of income distribution among aged women in the different residential areas as was noted among aged men. Aged women in the farm population included a larger proportion with low incomes than the other

TABLE XI.—Persons 65 Years of Age and Over, by Income Status, 1950

Area	No Income	\$1-499 or Loss	\$500-999	\$1,000- 1,499	\$1,500- 1,999	\$2,000 and Over	Median Income
(Percentages)							
<i>Males</i>							
<i>The State</i>	10.9	12.4	49.6	8.8	4.8	13.5	\$ 823.00
Rural-Farm	9.8	16.5	55.7	8.7	2.8	6.5	757.00
Urban and							
Rural-Nonfarm	11.4	11.1	47.7	8.8	5.5	15.5	849.00
New Orleans	12.8	8.8	34.2	10.9	9.0	24.3	1,027.00
<i>Females</i>							
<i>The State</i>	32.0	14.7	45.5	3.2	1.3	3.3	\$ 712.00
Rural-Farm	32.0	15.1	49.2	1.7	0.7	1.3	692.00
Urban and							
Rural-Nonfarm	32.0	14.6	44.7	3.5	1.5	3.7	717.00
New Orleans	37.7	13.8	37.2	4.5	2.0	4.8	733.00

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Table 89.

areas and a smaller proportion with relatively high incomes, but the difference was not as great as that observed among aged men. In 1950, 32.0 per cent of the aged women on farms had no income; 15.1 per cent received from \$1 to \$499 or sustained a loss; 49.2 per cent received \$500 to \$999; 1.7 per cent had incomes of \$1,000 to \$1,499; 0.7 per cent received \$1,500 to \$1,999; and 1.3 per cent received more than \$2,000.

The data show that aged women have higher proportions with no income than aged men; that aged men in rural-farm areas have relatively high proportions with low incomes; and that aged men in the urban and rural-nonfarm populations have comparatively large proportions with the higher incomes. Furthermore, the figures on income reveal that income distribution among aged women does not show the significant differences between the various residential areas as prevailed among men.

Trends

In examining trends in the proportion of aged persons in the farm population, one finds that this group has approximately doubled since 1920. Data on the age composition of the rural-farm population are not available prior to that year. In 1920, aged persons made up 3.2 per cent of the total farm population, and a continued increase has been recorded in their relative numbers at every subsequent census. In 1930, the aged accounted for 3.4 per cent of the farm population; in 1940, they constituted 4.7 per cent; and in 1950, they made up 6.3 per cent. Even though the aged persons in the farm population have about doubled in the last three decades from a relative standpoint, an actual decline has been recorded in absolute numbers since 1940. In 1920, they numbered 25,103 persons; in 1930, 27,691 persons; in 1940, 39,977 persons; and in 1950, only 35,629 persons. The absolute decline, as can be observed, occurred only in the decade between 1940 and 1950. In the two preceding decades, small absolute increases occurred. These differences between the relative and the absolute changes of the aged in the farm population result, of course, from the changing total farm population which serves as the base for computing proportional representation of the aged among farm people. During the 1940-1950 decade the total farm population of the state declined more rapidly than did the number of aged persons in it. This resulted in a proportional increase of the aged notwithstanding the decline in total farm population.

Increases in the proportion of the aged in the other residential areas of the state have also been recorded since 1920. The aged made up 3.3 per cent of the rural-nonfarm population in 1920; 3.7 per cent in 1930; 5.0 per cent in 1940; and 6.9 per cent in 1950. In the urban population, they constituted 3.5 per cent in 1920; 3.8 per cent in 1930; 5.4 per cent in 1940; and 6.6 per cent in 1950. The changes in the number of the aged in these residential areas differ from that in the farm

population in that an absolute as well as a relative increase occurred in each of them. The aged in the rural-nonfarm population numbered 12,734 persons in 1920; 16,258 persons in 1930; 26,485 persons in 1940; and 51,673 persons in 1950. Similar figures for the aged in the urban population are 21,986, 31,901, 52,541, and 89,502 persons respectively.

Data are available on the age composition of the state's total population prior to 1920. They show that in 1880 aged persons numbered only 24,894 and made up 2.6 per cent of the population. Since that year, a continuous increase has taken place both in the absolute and relative number of the aged in the state. From a relative standpoint, this increase is reflected in the following percentages which the aged comprised of the population in the years indicated: 2.9 per cent in 1890; 2.9 per cent in 1900; 3.0 per cent in 1910; 3.3 per cent in 1920; 3.6 per cent in 1930; 5.0 per cent in 1940; and 6.6 per cent in 1950. From an absolute standpoint, the trend in the aged shows that they numbered 22,369 persons in 1890; 40,223 persons in 1900; 49,733 persons in 1910; 59,443 persons in 1920; 75,850 persons in 1930; 119,003 persons in 1940; and 176,849 persons in 1950. These data clearly show that there has been a longtime trend toward an increasing relative and absolute number of aged persons in the population of Louisiana. Assuming that the factors responsible for this change are not radically altered and observing the pattern of aging in other areas of the nation, one can safely predict that the aged will continue to increase from both relative and numerical standpoints in the state's population for the next several decades.

AGED FARM OPERATORS

A farm operator is defined as a "person who operates a farm either performing the labor himself or directly supervising it."² Therefore, the farm operator is the vital productive element in the rural society. For each farm the United States Census of Agriculture lists only one operator so that the number of farm operators corresponds to the number of farming establishments. The socio-economic characteristics of farm operators are valuable indexes of the nature of agriculture and rural life within a particular area. Age is an important characteristic because society tends to prescribe different roles for persons in the various broad age groups. Aged persons are considered to be in a stage of life when reduced activity and retirement are proper steps to be taken. It follows that the proportion of the farm operators of the state classified as aged assumes crucial significance.

This phase of the study centers upon the aged farm operators of the state in 1950. Attention is directed specifically at their number and distribution, their tenure status, their economic status, and the size and type of their farming operation. This approach, it is be-

² United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, p. xii.

lieved, will contribute to our knowledge and understanding of aged farm operators in the state. Their problems and their needs as well as their relative contribution to the state's agricultural economy should be more apparent from the results of this analysis.

Number and Distribution

In Louisiana in 1950 there were 124,022 farm operators of which 15,277 were known to be 65 years of age and over. No data were available on the ages of 9,331 farm operators and they are excluded from the following analysis. Farmers who were 65 years of age and over made up 13.3 per cent of all farm operators whose ages were reported. Aged farmers, however, are not uniformly distributed throughout the state. In some areas, they constitute significantly larger proportions of the total number of farm operators than in other areas. Figure 6 shows the relative importance of aged farm operators by State economic areas.⁴ These groupings of parishes are as follows:

- I. State economic area 1 (A): Bossier, Natchitoches, Rapides, Red River.
Metropolitan area A (1): Caddo.
- II. State economic area 2: Catahoula, Concordia, East Carroll, Franklin, Madison, Morehouse, Ouachita, Richland, Tensas, West Carroll.
- III. State economic area 3: Avoyelles, Evangeline, Lafayette, Pointe Coupee, St. Landry.
- IV. State economic area 4: Bienville, Caldwell, Claiborne, Grant, Jackson, La Salle, Lincoln, Union, Webster, Winn.
- V. State economic area 5 (B): East Baton Rouge, East Feliciana, Livingston, Plaquemines, St. Charles, St. Helena, St. Tammany, Tangipahoa, Washington, West Feliciana.

⁴ This analysis is presented in terms of State economic areas as formulated by the United States Census. "State economic areas represent groupings of counties within a State. The counties comprising a State economic area have similar agricultural, demographic, climatic, physiographic, and cultural characteristics . . . For the purpose of presenting agricultural statistics, most metropolitan areas have been combined with adjacent economic area when the number of farms and agricultural production of the metropolitan area are of small significance . . . Outside the metropolitan areas, the State economic areas in general are the same as State type-of-farming areas . . . Since counties comprising each State economic area have similar characteristics, data for a State economic area may be used for describing, with reasonable accuracy, the characteristics of the agriculture in each county making up the area." (United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I. Part 24, p. xi.)

Metropolitan area B (5): Jefferson, Orleans, St. Bernard.

VI. State economic area 6: Ascension, Assumption, Iberia, Iberville, Lafourche, St. James, St. John the Baptist, St. Martin, St. Mary, Terrebonne, West Baton Rouge.

VII. State economic area 7: Acadia, Allen, Calcasieu, Cameron, Jefferson Davis, Vermilion.

VIII. State economic area 8: Beauregard, De Soto, Sabine, Vernon.

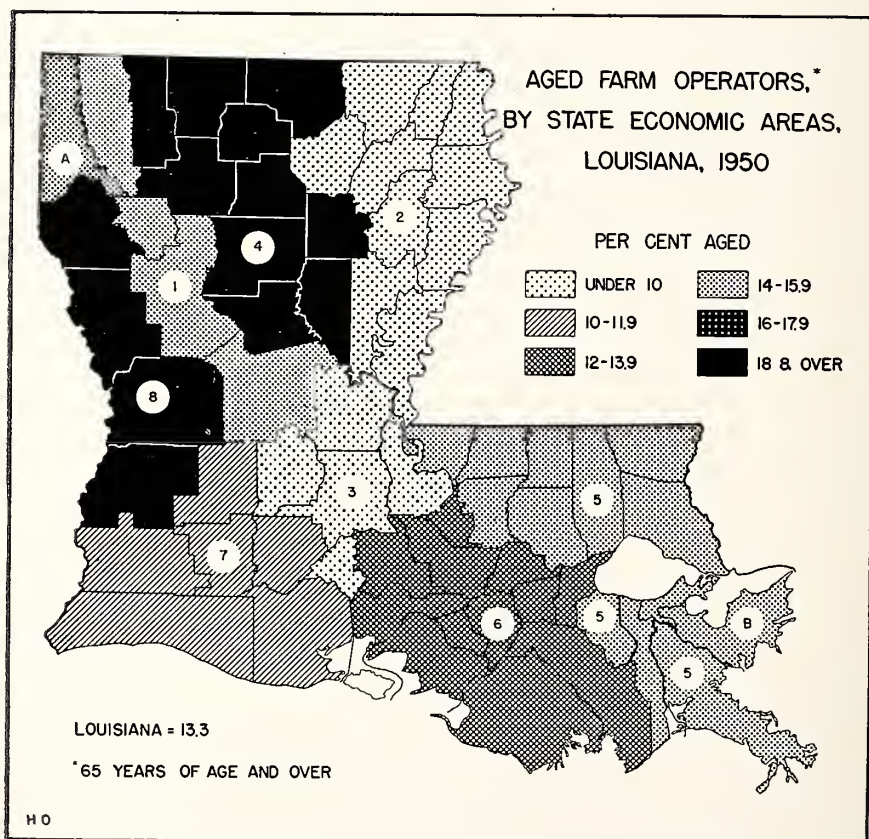


FIGURE 6.—Aged Farm Operators, by State Economic Areas, Louisiana, 1950. (Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. 1, Part 24.)

Data for 1950 reveal that in State economic areas 4 and 8 exceedingly large proportions of farmers were in the aged category. In State economic area 4, aged farmers made up 19.6 per cent of the total number of farm operators. The corresponding figure for State economic area 8 is 19.0 per cent. On the other hand, aged farm operators were of much less relative significance in State economic areas 2 and 3. In the former, they made up 9.9 per cent of the farmers, and in the latter they constituted only 9.0 per cent; in area 5 and B, they constituted 13.4 per cent; in area 6, they accounted for 12.8 per cent; and in area 7, they made up 11.7 per cent. In terms of absolute numbers, aged farm operators were represented in the different economic areas as follows: Area 1 and A, 2,004; Area 2, 2,155; Area 3, 1,775; Area 4, 2,967; Area 5 and B, 2,541; Area 6, 1,065; Area 7, 1,287; and Area 8, 1,483.

Another indicator of the importance of aged farm operators is the average age of all farm operators. In 1950, the average farm operator in Louisiana was 46.8 years of age. The highest average age of farm operators was recorded in State economic area 4, in which farmers averaged 50.4 years of age. On the other hand, the lowest average age of farm operators (43.9 years) was found in State economic area 3. In the other areas, the average age of farm operators was as follows: State economic area 1 and A, 47.9 years; State economic area 2, 44.5 years; State economic area 5 and B, 47.6 years; State economic area 6, 47.7 years; State economic area 7, 46.0 years; and State economic area 8, 49.7 years.

These data indicate that aged persons do comprise a substantial share of the farm operators of the state, and they show further that farmers in advanced years of life are relatively more important in certain areas of the state as compared to others.

Racial Characteristics

Of the 15,277 farm operators in the state in 1950 reporting their ages as 65 years and over, about two-thirds (66.6 per cent) were white and one-third (33.4 per cent) were nonwhite. Specifically, there were 10,172 white persons operating farms who reported their ages as 65 years and over. The corresponding figure for nonwhite farm operators was 5,105 persons.

The most significant fact revealed from the data on racial characteristics of farm operators is that elderly persons are of about equal relative importance among both white and nonwhite farmers. Table XII shows the ages of farm operators of Louisiana in 1950 by race. The aged accounted for 13.2 per cent of the white farm operators and for 13.6 per cent of their nonwhite counterparts. These figures mean that aged individuals are found in about equal proportion among white and nonwhite farm operators.

A further study of Table XII discloses that among nonwhite farm operators young people under 25 years of age were almost twice as important as among white farm operators in 1950. This seems to be one

TABLE XII.—Age of Farm Operators, Louisiana, 1950, by Race

Age (in years)	Total		White		Nonwhite	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
<i>TOTAL</i>	<i>114,691*</i>	<i>100.0</i>	<i>77,314</i>	<i>100.0</i>	<i>37,377</i>	<i>100.0</i>
Under 25	6,006	5.2	3,281	4.2	2,725	7.3
25-34	18,772	16.4	12,644	16.4	6,128	16.4
35-44	28,959	25.3	20,151	26.1	8,808	23.6
45-54	25,959	22.6	17,433	22.5	8,526	22.8
55-64	19,718	17.2	13,633	17.6	6,085	16.3
65 and over	15,277	13.3	10,172	13.2	5,105	13.6

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Live-stock and Products, Crops, Fruits, Values," Vol. I, Part 24, Table 15.

*9,331 farm operators did not give their ages in 1950 and are not included in this table.

of the important differences between the age structures of white and nonwhite farm operators in the state. The nonwhites also had a slightly smaller proportion of farm operators in the middle years of life, from 35 to 64 years of age. These data suggest that nonwhite farm youth tend to remain in agriculture to a greater degree than their white counterparts.

Tenure Status

Aged farm operators in the state in 1950 were predominantly full owners of the farms which they operate.⁵ Almost two-thirds (64.0 per cent) of them were in this category. Another 7.0 per cent of the aged farm operators were classified as part owners. Thus, the owner category includes almost three-fourths of all aged farm operators. Only 0.9 per cent of the aged farm operators were classified as managers, and 28.1 per cent of them were tenants. The data show, however, that much variation exists among the different State economic areas in the tenure status of aged farm operators. In areas 5 and B, and 8, more than 80 per cent of the aged farm operators were classified as full owners. (See Table XIII.) Also in State economic areas 3, 4, and 7, the proportions of the aged farmers classified as full owners exceeded 70 per cent.

Aged farm operators were classified as part owners in significant proportions only in State economic areas 6 and 7. In these areas, 17.1 per cent and 13.6 per cent respectively of the aged farm operators had tenure as part owners. This tenure status was least important among aged farm operators in State economic areas 5 and B, in which it accounted for only 2.3 per cent of all aged farmers.

⁵ "In the 1950 Census, farm operators are classified according to the tenure under which they hold their land on the basis of replies to the inquiries on total land owned, total land rented from others, and total land managed for others . . . *Full owners* own land but do not rent land from others. *Part owners* own land and rent land from others. *Managers* operate farms for others and are paid a wage salary for their services . . . *Tenants* rent from others or work on shares for others all the land they operate." United States Census of Agriculture, 1950, *Age, Residence, Years on Farm, Work Off Farm*, Vol. II, Ch. 2, p. xxx.

TABLE XIII.—Aged Farm Operators,* by Tenure Status, Louisiana and State Economic Areas, 1950

State Economic Area	Tenure Status			
	Full Owners	Part Owners	Managers	Tenants
	(Percentages)			
<i>The State</i>	64.0	7.0	0.9	28.1
Area 1 and A	47.4	9.3	0.3	43.0
Area 2	41.2	4.4	1.3	53.1
Area 3	70.7	5.4	0.3	23.6
Area 4	79.4	6.5	. .	14.1
Area 5 and B	81.7	2.3	1.0	15.0
Area 6	60.9	17.1	6.2	15.8
Area 7	74.9	13.6	0.2	11.3
Area 8	80.3	4.9	0.3	14.5

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Live-stock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Economic Area Table 6.

*65 years of age and over.

In general, the status of manager was not found to any significant extent among aged farm operators except in State economic area 6, in which it made up 6.2 per cent of the aged farmers. Besides this area, only in State economic areas 2, and 5 and B, did the aged farmers classified as managers amount to as much as 1.0 per cent. None of the aged farm operators in State economic area 4 was classified as a manager in 1950.

The data in Table XIII show that in State economic area 2 more than one-half of the aged farm operators were classified as tenants. Besides this area, relatively large numbers of the aged farm operators were listed as tenants in State economic areas 1 and A, and 3, the percentages being 43.0 and 23.6 respectively. Tenancy among aged farm operators was least important in State economic areas 4 and 8, in which less than 15.0 per cent of them were so classified.

An examination of the tenure status of aged farm operators by race reveals some very significant differences. Unfortunately, the data on this subject are relatively meager. Out of a total number of 10,172 farms operated by aged white persons, information as to tenure status of 3,073 of them was collected by the Census of Agriculture in 1950. These data show that 81.7 per cent of the aged white farm operators were classified as full owners; 8.5 per cent were part owners; 1.5 per cent were managers; and 8.3 per cent were tenants. Aged nonwhite farm operators numbered 5,105 in 1950, of which data on tenure status are available for only 1,869. A much lower proportion of the aged nonwhite farm operators were classified as full owners than among their white counterparts (34.8 per cent compared to 81.7 per cent respectively). Similarly, a much larger proportion of the aged nonwhite farm operators were classified as tenants than among aged white farm operators, the proportions being 60.7 and 8.3 per cent respectively. Part owners accounted for 8.5 per cent of the aged white farm operators and

4.4 per cent of the aged nonwhite farmers. Aged white and nonwhite farm operators were classified as managers only in insignificant proportions (1.5 per cent and 0.1 per cent respectively).

The relative importance of aged farmers among all farm operators of the state, by tenure status, is portrayed in Figure 7. This chart shows that more than one out of ten of the state's farm operators (13.3 per cent) was 65 years of age and over in 1950. Furthermore, it indicates that aged farm operators are relatively most important among full owners and managers and least important among part owners and tenants. Of the full owners in the state in 1950, 13.8 per cent were 65 years of age and older. The corresponding figure for managers was 10.5 per cent. On the other hand, only 4.2 per cent of the part owners and only 4.1 per cent of the tenants were aged.

Considerable variations are noted in the significance of aged farm operators in the different State economic areas by tenure. (See Table XIV.) Among full owners, aged farm operators were of greatest relative importance in State economic areas 4 and 7. In these areas they constituted 19.9 per cent and 18.3 per cent respectively of all full owners. Also in State economic areas 6 and 8, they made up more than 16.0 per cent of all full owners. Aged farm operators were of least importance

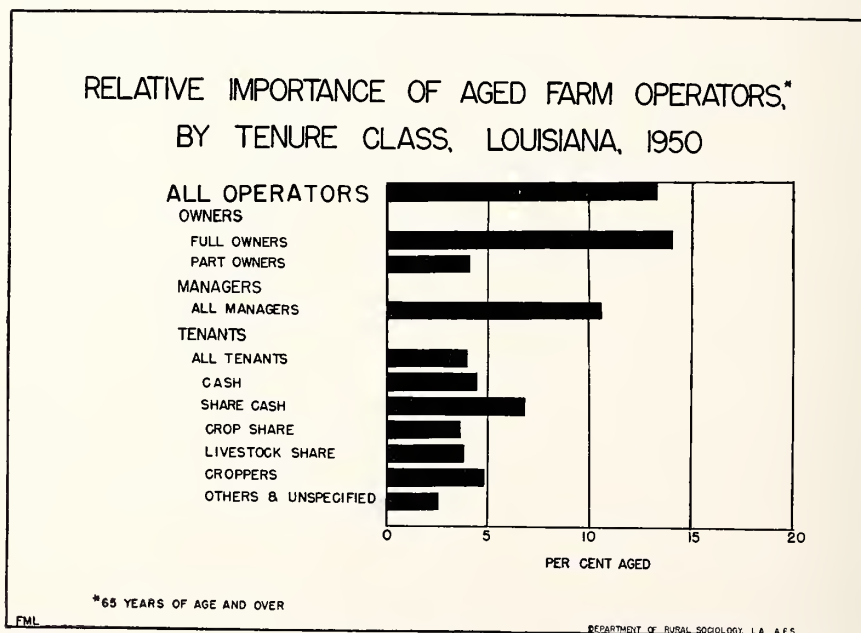


FIGURE 7.—Relative Importance of Aged Farm Operators, by Tenure Class, Louisiana, 1950. (Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 6.)

in State economic area 5 and B, in which they accounted for only 10.5 per cent of the full owners. The aged were also relatively less numerous among full owners in State economic areas 2 and 3.

In three of the State economic areas—numbers 1 and A, 4, and 8—aged farm operators accounted for more than 6.0 per cent of all part owners. The aged were of greatest relative importance in this tenure class in State economic area 1 and A, in which they made up 7.4 per cent of the part owners. They were of least importance in State economic area 5 and B, accounting for only 2.0 per cent of the part owners. State economic area 3 also recorded a small proportion of aged farm operators among part owners (2.5 per cent).

Relatively small proportions of tenant operators are comprised of aged persons. Only in State economic areas 1 and A, 2, and 5 and B did aged farm operators classified as tenants exceed 5.0 per cent of the total number of tenants. In these areas, the percentages were 5.8, 5.8, and 5.6 respectively. In the other State economic areas, the aged among farm tenants were of even less importance. In State economic area 3, they made up only 1.9 per cent of all tenants, and in State economic areas 6 and 7, they accounted for 2.5 and 2.0 percent respectively.

The number of farms in Louisiana operated by managers in 1950 was comparatively small, and the importance of aged farm managers varied considerably from one State economic area to another. Only State economic area 6 had more than 100 farms operated by managers (147 farms) and 13.6 per cent of them were in the hands of persons 65 years of age and over. Of the 93 farm managers in State economic area 2, approximately 16 per cent were aged—the highest proportion in any of the areas. In the other State economic areas, the number of

TABLE XIV.—The Relative Importance of Aged Farm Operators,* by Tenure Class, Louisiana and State Economic Areas, 1950

State Economic Area	Proportion of Farm Operators 65 Years of Age and Over				
	All Farm Operators	Full Owners	Part Owners	Managers**	Tenants
	(Percentages)				
<i>The State</i>	13.3	13.8	4.2	(449) 10.5	4.1
Area 1 and A	15.0	14.3	7.4	(53) 3.8	5.8
Area 2	9.9	11.2	3.7	(93) 16.2	5.8
Area 3	9.0	11.9	2.5	(36) 5.6	1.9
Area 4	19.6	19.9	6.1	(11) . .	4.3
Area 5 and B	14.4	10.5	2.0	(68) 8.8	5.6
Area 6	12.8	16.7	4.5	(147) 13.6	2.5
Area 7	11.7	18.3	4.3	(37) 2.7	2.0
Area 8	19.0	16.9	6.0	(4) . .	3.8

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 6.

*65 years of age and over.

**In some of the economic areas, there are fewer than 100 managers. The figure in parentheses shows the actual number of managers in each State economic area.

farms operated by managers ranged from 0 to 68 and the proportion of aged managers ranged from 0 to 8.8 per cent.

Type of Farming Operation

A study of the type of farming being carried on by aged farm operators in Louisiana in 1950 reveals that more than half of them (51.6 per cent) were operating cotton farms. Table XV presents the type of farms operated by aged farm operators in 1950 by State economic areas. This table shows that the second most common type of farm operated by aged farm operators is that devoted to the production of livestock other than poultry. More than one-fifth (22.8 per cent) of them had this type of farm in 1950. Thus, about three-fourths of the aged farm operators of the state were established on cotton farms and farms producing livestock other than poultry. Of the other types of farms, none made up as much as 10 per cent of the total number of farms operated by aged farmers. Cash grain farms were operated by 6.4 per cent of the aged farm operators to rank as the third most important type. Farms producing other field crops were fourth in importance.

The two types of farms, cotton and livestock other than poultry, were most important among aged farm operators in State economic areas 1 and A, 2, 3, 4, and 8. In State economic area 2, 84.5 per cent of the farms operated by aged persons were devoted to cotton growing. In State economic area 1 and A, the corresponding figure was 71.9 per cent. Approximately one-fourth of the aged farm operators were on farms producing livestock other than poultry in State economic areas 3, 4, 5 and B, 7, and 8. This type of farm was found in largest proportion among aged farm operators in State economic area 3 (32.1 per cent). In State economic area 8, the proportion was 30.6 per cent.

The aged farm operators in only three of the State economic areas deviated significantly from the pattern of cotton or livestock other than poultry farming as described above. In State economic area 6, more than one-half (54.9 per cent) of the aged farm operators had farms producing other field crops. This State economic area also had a comparatively high proportion (11.4 per cent) of the aged farm operators in general farming. In State economic area 7, almost one-half (49.2 per cent) of the aged farm operators were on farms producing cash grain crops. A much greater diversity of types of farms among aged farm operators characterized State economic area 5 and B. About one-fourth of them (24.8 per cent) had cotton farms, approximately one-fourth (24.6 per cent) had livestock other than poultry farms, almost one-fifth (18.7 per cent) had farms producing fruits and nuts, slightly more than one-tenth (11.9 per cent) had dairy farms, and a significant proportion (7.1 per cent) had poultry farms.

These data show that the great majority of aged farm operators in Louisiana in 1950 were operating cotton farms and farms producing

TABLE XV.—Aged Farm Operators,* by Type of Farm, Louisiana and State Economic Areas, 1950

State Economic Area	Type of Farm						
	Cash Grain	Cotton	Other Field Crop	Vegetable	Fruit and Nut	Dairy	Livestock other than Poultry
					(Percentages)		
<i>The State</i>	6.4	51.6	5.7	0.9	2.4	3.2	22.8
Area 1 and A	. .	71.9	1.2	. .	0.3	0.9	17.4
Area 2	0.3	84.5	. .	. .	. .	0.4	11.9
Area 3	8.0	45.1	5.7	0.7	. .	2.3	32.1
Area 4	. .	54.1	1.5	2.2	. .	5.2	28.8
Area 5 and B	0.9	24.8	3.5	3.5	18.7	11.9	24.6
Area 6	0.6	6.3	54.9	1.6	3.1	3.5	17.0
Area 7	49.2	13.4	3.4	. .	. .	1.2	29.6
Area 8	. .	55.3	1.5	. .	. .	3.3	30.6

Source: United States Census of Agriculture, 1950, *Louisiana*. "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 7.

*65 years of age and over.

livestock other than poultry. These two types of farms made up approximately three-fourths of all farms operated by aged persons. Other types of farms which were found in significant proportions among aged farm operators were cash grain farms in State economic area 7; farms producing other field crops and general farms in State economic area 6; and fruit and nut farms and dairy farms in State economic area 5 and B.

If the types of farms being operated by aged farmers are studied according to their relative importance among the total number of farms of each type in Louisiana in 1950, some interesting observations are revealed. For instance, although almost three-fourths of the aged farmers themselves were operating cotton or livestock farms, they were relatively most important among the poultry farmers of the state. Figure 8 shows that almost one-fourth (22.7 per cent) of the poultry farms of Louisiana were operated by persons 65 years of age and over in 1950. Aged farm operators were relatively significant among operators of general, primarily livestock, farms. They accounted for 20.1 per cent of all operators of farms of this type. Among farms producing livestock other than dairy and poultry, aged persons made up 19.0 per cent of all farmers with this type of farm. Among farms classified as miscellaneous and unclassified, the aged individuals accounted for 20.9

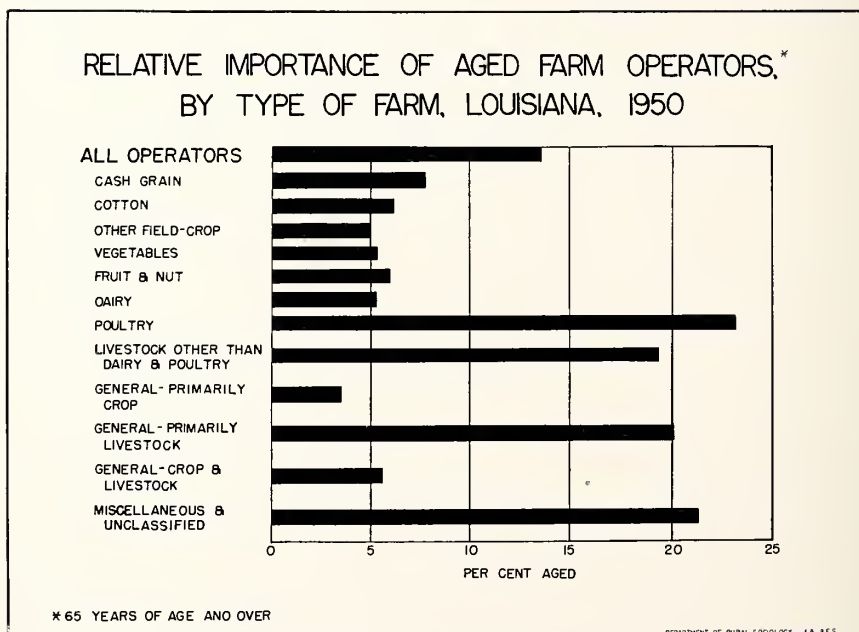


FIGURE 8.—Relative Importance of Aged Farm Operators, by Type of Farm, Louisiana, 1950. (Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 7.)

per cent of the farmers with this type of farm. No other type of farm registered nearly as high a proportion of aged operators as the ones cited above.

Aged persons were relatively least important among operators of general, primarily crop, farms; farms producing "other field crops"; vegetable farms; dairy farms; and fruit and nut farms. In each of these types of farms, aged operators accounted for less than 6.0 per cent of the farmers in each type. It is of interest to note, also, that aged farm operators accounted for only 6.3 per cent of all cotton farmers, even though approximately one-half of them had this type of farming operation in 1950.

In examining the relative importance of aged farm operators among the different types of farms in the State in 1950 by State economic areas, some unusual patterns are revealed. (See Table XVI.) In some State economic areas, aged farm operators constituted more than half of the farmers with certain types of farming operations. In State economic area 5 and B, aged farm operators made up half of the persons with cash grain farms. However, there were only ten farms of this type in this area. In State economic area 2, there were eleven farms classified as general, primarily livestock, and six of them were in the hands of aged operators. In State economic area 3, ten such farms existed in 1950 and half of them were in the hands of aged farm operators. State economic area 8 recorded five farms classified as general, primarily livestock, and all of them were operated by persons 65 years of age and over. Because of the small number of farms involved in the above cases, the significance of the high proportion of aged farm operators is reduced insofar as the total position of aged farmers is concerned.

A study of the significance of the aged farm operators among the various types of farms, by State economic areas, generally shows, outside of the exceptions noted above, that a pattern very similar to that described for the State as a whole prevails in the different areas. Aged operators are relatively most numerous among poultry farmers, persons with farms classified as general, primarily livestock, and livestock other than dairy and poultry farmers. A high proportion of the farms listed as miscellaneous and unclassified is also in the hands of aged persons.

Size of Farming Operation

Aged farm operators in Louisiana in 1950 had, for the most part, farms of less than 70 acres. Actually, 68.1 per cent of them were operating farms in this size class, and 31.9 per cent had farms of 70 acres and over. The data presented in Table XVII show that 15.3 per cent of the aged farmers had farms under 10 acres in size, 27.9 per cent had farms of 10 to 29 acres, 16.9 per cent were operating farms of 30 to 49 acres, and 8.0 per cent of them had farms of 50 to 69 acres. These figures show that almost half (43.2 per cent) of the aged farmers had agricultural

TABLE XVI.—The Relative Importance of Aged Farm Operators,* by Type of Farm, Louisiana and State Economic Areas, 1950

State Economic Area	Type of Farm								Misc. and Unclas- sified		
	Cash Grain	Cotton	Other Field Crop	Vege- table	Fruit and Nut	Dairy	Poultry	Live- stock other than Dairy & Poultry		General, Primarily Live- stock	General Crop & Live- stock
<i>The State</i>	7.6	6.3	5.0	5.2	5.9	5.3	(Percentages)	19.0	20.1	7.4	20.9
Area 1 and A	..	7.1	18.4	..	9.1	3.4	30.8	12.9	12.5	10.3	23.0
Area 2	5.0	6.5	..	..	..	3.2	28.6	14.2	54.5	12.6	19.2
Area 3	6.6	3.5	1.9	25.0	..	..	26.8	22.5	50.0	1.4	20.4
Area 4	..	8.7	22.2	33.4	..	15.0	14.3	24.1	14.6	19.1	24.6
Area 5 and B	50.0	10.8	8.0	4.7	5.7	3.9	22.7	20.9	..	11.3	18.3
Area 6	4.7	3.3	6.8	1.8	15.4	12.2	14.3	17.4	33.4	6.3	20.1
Area 7	8.0	2.9	4.9	..	..	3.4	26.8	22.2	..	.7	17.2
Area 8	..	11.0	25.0	..	..	6.1	23.5	17.1	100.0	1.3	22.7

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Economic Area Table 7.

*65 years of age and over.

enterprises of less than 30 acres. More than two-thirds of them, therefore, had small farms of under 70 acres, and almost half of them of less than 30 acres.

There is considerable variation in the size of farms operated by aged persons in the different economic areas. (See Table XVII.) In State economic area 4, more than half of them (53.0 per cent) had farms of 70 acres and over in 1950. Also in State economic areas 7 and 8, 36.4 per cent and 36.7 per cent respectively of the aged farm operators had farms of this size. On the other hand, only 17.5 per cent of the aged farm operators in State economic area 3 had farms of 70 acres and over in 1950. Other State economic areas in which small proportions of the aged farm operators had farming enterprises of 70 acres and over were areas 2, and 5 and B. In the former, 21.1 per cent had such farms, and in the latter 24.0 per cent were on farms of 70 acres and over.

At the other extreme, in State economic areas 3 and 6, more than one-fifth of the aged farm operators had farmsteads of less than ten acres. The proportions in 1950 were 22.0 and 22.5 per cent respectively. In two of the State economic areas, 4 and 8, relatively small numbers of the aged farmers had such small farms. In State economic area 4, only 8.4 per cent of them had farms under 10 acres in size, and in State economic area 8, only 7.7 per cent of the farms operated by aged persons were in that category.

Aged farm operators were of least relative importance in 1950 among individuals with farms of 10 to 29 acres, 30 to 49 acres, and 50 to 69 acres. Among persons with farms of 10 to 29 acres, aged operators made up 10.9 per cent. (See Figure 9.) Similarly, they accounted for 10.6 per cent of those persons with farms of 30 to 49 acres, and 13.2 per cent of those with places of 50 to 69 acres. It is of interest to note that 16.7 per cent of the very large estates (1,000 acres and over) were

TABLE XVII.—Aged Farm Operators,* Louisiana and State Economic Areas, 1950, by Size of Farm

State Economic Area	Size of Farm (in Acres)				
	Under 10	10-29	30-49	50-69	70 and over
	(Percentages)				
<i>The State</i>	15.3	27.9	16.9	8.0	31.9
Area 1 and A	16.5	30.4	15.5	7.8	29.8
Area 2	16.0	42.9	14.2	5.8	21.1
Area 3	22.0	36.3	16.9	7.3	17.5
Area 4	8.4	13.0	15.8	9.8	53.0
Area 5 and B	17.5	30.8	17.1	8.1	26.5
Area 6	22.5	28.6	19.3	5.6	24.0
Area 7	17.1	23.1	15.9	7.5	36.4
Area 8	7.7	20.9	24.3	10.4	36.7

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Live-stock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Economic Area Table 5.

*65 years of age and over.

RELATIVE IMPORTANCE OF AGED FARM OPERATORS,^{*} BY SIZE OF FARM, LOUISIANA, 1950

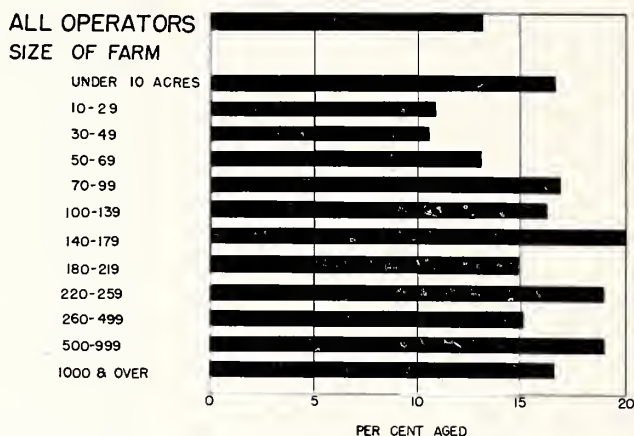


FIGURE 9.—Relative Importance of Aged Farm Operators, by Size of Farm, Louisiana, 1950. (Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 5.)

in the hands of aged farm operators. Also, an almost equal proportion (16.8 per cent) of the very small farms (under 10 acres) was operated by aged persons.

In general, the data indicate that the proportionate importance of aged farm operators does vary considerably among the different sized farm enterprises. By and large, the prevailing pattern seems to be for aged farmers to be disproportionately concentrated among the operators of very small farms (under 10 acres) and of larger farms (70 acres and over). On the other hand, they are underrepresented among the operators of the intermediate sized units of from 10 to 70 acres. Thus, in this connection, they tend to be either small operators or operators of the somewhat larger farms.

A study of the relative importance of aged farm operators according to size of farms by State economic areas shows that aged persons did not dominate any of the various classes of farms in any single area. (See Table XVIII.) In State economic area 4, aged farm operators made up one-third (32.2 per cent) of the persons with agricultural enterprises of 220 to 259 acres in size and more than one-third of the individuals with farming enterprises of 500 to 999 acres. Also, in

TABLE XVIII.—The Relative Importance of Aged Farm Operators,* by Size of Farm, Louisiana and State Economic Areas, 1950

State Economic Area	Size of Farm										1000 Acres and Over
	Under 10 Acres	10-29 Acres	30-49 Acres	50-69 Acres	70-99 Acres	100-139 Acres	140-179 Acres	180-219 Acres	220-259 Acres	260-499 Acres	500-999 Acres
							(Percentages)				
<i>The State</i>	16.8	10.9	10.6	13.2	17.1	16.5	20.3	15.1	19.2	15.3	19.2
Area 1 and A	16.8	11.9	12.8	18.3	25.3	18.4	16.1	13.5	20.0	11.8	24.8
Area 2	15.3	10.6	6.6	7.3	7.2	8.7	18.1	2.1	14.4	12.2	23.7
Area 3	20.6	7.5	5.5	8.1	14.3	10.4	33.3	16.5	16.7	7.3	10.9
Area 4	17.9	12.6	15.3	19.3	25.1	23.3	29.9	22.8	32.2	26.4	36.7
Area 5 and B	14.9	12.5	13.9	14.9	16.1	17.0	17.5	21.5	15.6	20.4	15.5
Area 6	20.2	12.3	12.2	8.5	10.2	9.5	9.1	13.9	10.5	14.2	11.0
Area 7	13.6	11.1	10.3	12.3	14.4	8.5	14.6	6.4	13.0	9.2	14.6
Area 8	20.0	16.1	18.0	21.0	19.9	26.4	18.7	21.3	24.3	19.6	15.1
											14.5

Source: United States Census of Agriculture, 1950, Louisiana, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 5.

*65 years of age and over.

State economic area 3, aged farm operators accounted for 33.3 per cent of the persons with farms of 140 to 179 acres in size. These were the most significant representations of the aged among farm operators in the various classes of farms in any of the State economic areas. In no other cases did the relative importance of aged farm operators exceed 30.0 per cent. However, in State economic area 1 and A, they comprised about one-fourth of the farmers with agricultural enterprises of 70 to 99 acres and 500 to 999 acres. Also in State economic area 2, they made up almost one-fourth of the operators of farms of 500 to 999 acres. Aged farmers constituted approximately one-fourth of the individuals in State economic area 4 with farms of 70 to 99 acres, 100 to 139 acres, 140 to 179 acres, 180 to 219 acres, 260 to 499 acres, and 1,000 acres and over. In State economic area 8, aged farm operators composed one-fourth of the persons with farms of 100 to 139 acres and 220 to 259 acres. In no other State economic areas did they account for such proportions in any class of farm.

Aged farm operators were relatively unimportant among persons with farms of 30 to 49 acres, 50 to 69 acres, 70 to 99 acres, 100 to 139 acres, and 180 to 219 acres in State economic area 2. In none of these classes did aged farmers account for as many as one-tenth of the farm operators. In fact, in the 180 to 219 acre class of farm, they made up only 2.1 per cent. Aged persons were also of little significance (less than 10.0 per cent) among persons with farms of 30 to 49 acres, 50 to 69 acres, and 260 to 499 acres in State economic area 3. Such a low representation of the aged among farm operators was found also in State economic area 6 among persons with farms of 50 to 69 acres, 100 to 139 acres, and 140 to 179 acres. A similar situation obtained among farmers with agricultural enterprises of 100 to 139 acres, 180 to 219 acres, and 260 to 499 acres in State economic area 7.

These data indicate that aged farm operators were relatively of most importance among persons with farms above 20 acres in size in State economic area 4, and were of least relative importance among persons with farms of 10 to 140 acres in State economic area 2. Generally, the aged farm operators were of lesser importance among all classes of farms in State economic areas 3, 6, and 7. In no case did they constitute more than one-third of the total number of farmers in a single class of farms.

Economic Status of the Farming Operation

The Census of Agriculture of 1950 classified farms into three types: (1) commercial farms, (2) part-time farms, and (3) residential farms. Of the 15,277 farms in the state in 1950 operated by persons 65 years of age and over, 32.3 per cent were classified as commercial farms, 18.0 per cent were part-time farms, and 49.7 per cent were residential farms. Therefore, almost one-half of the farms operated by aged persons were classified as residential farms. Only one-third of the aged

TABLE XIX.—Aged Farm Operators,* by Economic Class of Farm, Louisiana and State Economic Areas, 1950

State Economic Area	Total Number of Farms		Commercial Farms		Part-Time Farms		Residential Farms	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
<i>The State</i>	15,277	100.0	4,942	32.3	2,746	18.0	7,589	49.7
Area 1 and A	2,004	100.0	593	29.6	345	17.2	1,066	53.2
Area 2	2,155	100.0	1,171	54.3	347	16.1	637	29.6
Area 3	1,775	100.0	699	39.4	280	15.8	796	44.8
Area 4	2,967	100.0	710	23.9	625	21.1	1,632	55.0
Area 5 and B	2,541	100.0	607	23.9	547	21.5	1,387	54.6
Area 6	1,065	100.0	322	30.2	91	8.6	652	61.2
Area 7	1,287	100.0	494	38.4	221	17.2	572	44.4
Area 8	1,483	100.0	346	23.3	290	19.6	847	57.1

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Live-stock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Economic Area Table 8.

*65 years of age and over.

farm operators had farms classified as commercial, and less than one-fifth of them had part-time farms. According to the definition of a residential farm, about half of the aged farm operators were conducting agricultural enterprises of which the total value of sales of farm products was less than \$250.⁶ These people, therefore, must be dependent upon some other source of income for their livelihood. It may be assumed that these aged farm operators with residential farms are either persons who have reduced the scale of their farming activities due to advanced age or who have retired to a farm from the city or rural-nonfarm areas. In the latter case, it is likely that farming was never the major occupation of the persons involved.

In studying the economic class of farm operated by aged persons, by State economic areas, considerable variation becomes evident. Table XIX shows that 61.2 per cent of the aged farm operators in State economic area 6 had residential farms as compared to only 29.6 per cent in State economic area 2. Also, over half of the aged farm operators were on residential farms in State economic areas 1 and A, 4, 5 and B, and 8. No other State economic area recorded such a small percentage with residential farms as found in Area 2.

⁶ "In general, all farms with a value of sale of products amounting to \$1,200.00 or more were classified as commercial. Farms with a value of sales of \$250.00 to \$1,199.00 were classified as commercial only if the farm operator worked off the farm less than 100 days and the income of the farm operator and members of his family received from nonfarm sources was less than the total value of all farm products sold." "Farms with a value of sale of products of \$250.00 to \$1,199.00 were classified as part-time provided the farm operator reported (a) 100 or more days of work off the farm in 1940, or (b) the nonfarm income received by him and members of his family was greater than the value of farm products sold." "Residential farms include all farms except abnormal farms with a total value of sales of farm products of less than \$250.00." "Abnormal farms include public and private institutional farms, community enterprises, experiment station farms, grazing associations, etc." United States Census of Agriculture, 1950, *Age, Residence, Years on Farm, Work Off Farm*, Vol. II, Chapter II, p. xxxi.

Commercial farms were found to be most prevalent among aged farm operators in State economic area 2, in which 54.3 per cent of the farms operated by persons 65 years of age and over were so classified. No other State economic area had such a high proportion of commercial farms among its aged farm operators. Commercial farms were found to be least numerous among aged farm operators in State economic area 8. In this locality, only 23.3 per cent of the aged farm operators had commercial farms. Other State economic areas having low proportions of commercial farms among their aged farm operators were areas 4, and 5 and B. In both of these areas, less than one-fourth of the aged farmers operated commercial farms.

Part-time farming was most significant among aged farm operators in State economic area 4, and 5 and B. Slightly more than one-fifth of the aged farm operators in these areas had part-time farms. Part-time farming among aged farm operators was least important in State economic area 6, in which only 8.6 per cent of them had such agricultural enterprises.

In 1950, the Census of Agriculture also collected data relative to the economic status of commercial farms. Commercial farms were classified into six groups on the basis of the total value of products sold, as follows:

Class of Farm	Value of farm products sold
I	\$25,000 or more
II	\$10,000 to \$24,999
III	\$ 5,000 to \$ 9,999
IV	\$ 2,500 to \$ 4,999
V	\$ 1,200 to \$ 2,499
VI	\$ 250 to \$ 1,199

A study of the economic status of commercial farms operated by aged persons in 1950 shows that the bulk of them had low income agricultural enterprises. The data reveal that 47.5 per cent of them were operating Class VI commercial farms. This type of farm had an income between \$250 and \$1,199. Furthermore 30.2 per cent of the aged farm operators had Class V commercial farms. Therefore, over three-fourths of the aged farm operators in the state in 1950 had farms which were returning to them each year an income of less than \$2,500.

The proportion of aged farmers with high-income producing farms was relatively small. In 1950, only 1.9 per cent of the aged farm operators had farms (Class I) with incomes of \$25,000 or more. Another 3.6 per cent of them had farms in Class II, which had incomes between \$10,000 and \$24,999. These data clearly show that relatively few farm operators reach their declining years of life in possession of agricultural enterprises which are producing high incomes. Most of them are in possession of low-income farms.

An examination of the economic status of farms operated by aged persons, by State economic areas, shows that more than half of them had Class VI farms in areas 3, 4, and 5 and B. The figures are 52.2, 55.4, and 55.5 per cent respectively. (See Table XX.) On the other hand, only 29.6 per cent of the aged farm operators in State economic area 7 had Class VI farms. State economic area 6 also had a relatively small proportion (36.0 per cent) of its aged farm operators with Class VI farms. Class V commercial farms were found in greatest relative number among aged farm operators in State economic area 2. In this area, 36.9 per cent of the aged farm operators had Class V farms. The smallest representation of Class V commercial farms among aged farm operators was found in State economic area 6 (19.3 per cent).

High income producing farms were found in greatest relative numbers among aged farm operators in State economic areas 6 and 7. In the former, 8.7 per cent of the aged farmers were operating Class I commercial farms in 1950, and 11.8 per cent of them had Class II farms. Therefore, approximately one-fifth of the aged farmers in State economic area 6 had agricultural enterprises with annual incomes of \$10,000 and over. In State economic area 7, 5.4 per cent of the aged farm operators had Class I commercial farms and 11.5 per cent of them had Class II farms. In this area, about one-sixth of the aged farm operators had high income producing farms with returns of \$10,000 and over per year. No other State economic area had such a large proportion of its aged farm operators in possession of high income producing farms.

In State economic areas 2, 3, 4, and 8, very small proportions of the aged farm operators had high income producing farms. In none of these areas did as many as 3 per cent of the aged farm operators have Class I and Class II commercial farms. In State economic area 4, for

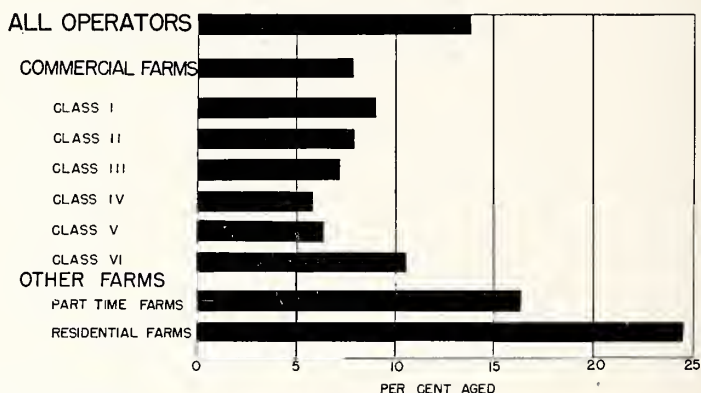
TABLE XX.—Aged Farm Operators,* by Economic Class of Commercial Farm, Louisiana and State Economic Areas, 1950

State Economic Area	Commercial Farms					
	Class I	Class II	Class III	Class IV	Class V	Class VI
	(Percentages)					
<i>The State</i>	1.9	3.6	5.6	11.2	30.2	47.5
Area 1 and A	1.9	3.9	6.9	12.6	33.7	41.0
Area 2	0.3	1.7	3.2	9.4	36.9	48.5
Area 3	1.2	1.3	4.7	5.3	35.3	52.2
Area 4	0.1	1.5	5.1	15.2	22.7	55.4
Area 5 and B	2.1	2.0	6.9	10.4	23.1	55.5
Area 6	8.7	11.8	8.1	16.1	19.3	36.0
Area 7	5.4	11.5	6.9	17.0	29.6	29.6
Area 8	0.3	2.6	7.8	6.7	30.3	52.3

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Economic Area Table 3.

*65 years of age and over.

RELATIVE IMPORTANCE OF AGED FARM OPERATORS,* BY ECONOMIC CLASS, LOUISIANA, 1950



* 65 YEARS OF AGE AND OVER

DEPARTMENT OF RURAL SOCIOLOGY, LA. A&S

FIGURE 10.—Relative Importance of Aged Farm Operators, by Economic Class, Louisiana, 1950. (Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 24, Economic Area Table 8.)

example, only 1.6 per cent of the aged farm operators had agricultural enterprises producing \$10,000 or more income per year.

An examination of the relative importance of aged farm operators within the various economic classes of farms shows that they are by far of greatest significance among persons with residential farms. Figure 10 shows that almost one-fourth (23.7 per cent) of the individuals with residential farms in the state in 1950 were 65 years of age and over. Aged farm operators were of considerable importance, also, among those persons with part-time farms. In fact, 15.6 per cent of the part-time farms in 1950 were operated by aged farmers. The data further show that aged farm operators were of least relative importance among persons with commercial farms. Only 7.6 per cent of the commercial farms of the state were in the hands of aged farm operators in 1950.

Insofar as the commercial farms are concerned, aged farmers were relatively most numerous among operators of Class VI farms. (See Table XXI.) One-tenth of the individuals with farms in this class was 65 years of age and over in 1950. On the other hand, aged farmers also were of significance among high income farms (Class I), in which they constituted 8.7 per cent of the persons with agricultural enterprises in this category. Aged farm operators were of least relative importance

TABLE XXI.—The Relative Importance of Aged Farm Operators,* by Economic Class, Louisiana, and State Economic Areas, 1950

State Economic Area	Proportion of Farm Operators 65 Years of Age and Over								
	Total All Commercial Farms	Economic Class							
		Commercial Farms						Part-time	Residential
		I	II	III	IV	V	VI		
				(Percentages)					
<i>The State</i>	7.6	8.7	7.7	6.9	6.1	10.1	15.6	23.7	
Area 1 and A	8.2	6.7	10.0	13.1	6.9	9.4	16.4	26.4	
Area 2	7.1	3.2	7.1	4.7	6.1	10.5	15.3	21.9	
Area 3	4.8	13.3	3.7	7.6	3.9	6.5	12.1	27.1	
Area 4	11.9	4.6	16.2	14.1	7.6	14.8	20.4	26.7	
Area 5 and B		11.4	4.6	6.6	7.2	11.6	14.7	20.3	
Area 6	7.0	10.2	9.9	4.3	5.7	8.4	9.8	23.4	
Area 7	7.7	9.6	7.2	4.2	7.1	11.2	15.0	18.3	
Area 8	12.4	3.1	11.7	19.2	11.2	13.8	16.8	25.7	

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. I, Part 2, Economic Area Table 8.

*65 years of age and over.

among persons with Class IV farms. In this class, only 5.5 per cent of the farmers were aged in 1950.

In considering the relative importance of aged farm operators by economic class of farm for the different State economic areas, one finds that they are relatively most numerous in areas 4 and 8. In State economic area 8 aged farmers constituted 12.4 per cent of the operators of commercial farms, 16.8 per cent of the individuals with part-time farms, and 25.7 per cent of those with residential farms. In State economic area 4, they made up 11.9 per cent of the persons with commercial farms, 20.4 per cent of those with part-time farms, and 26.7 per cent of the individuals with residential farms. The aged were of most importance in these two State economic areas among operators of commercial and part-time farms, and only in State economic areas 3, and 1 and A, did the aged constitute as large a proportion of the persons with residential farms.

The aged were of most relative importance among Class I farm operators in State economic areas 3, 5 and B, and 6. In each of these, they comprised more than 10 per cent. Among Class II and III farms, the aged were most important in State economic areas 1 and A, 4, and 8, in which they accounted for one-tenth or more of the persons with agricultural enterprises in each of these classes. They also made up more than one-tenth of the farmers with Class IV farms in State economic area 4. Among persons with Class V farms, the aged constituted one-tenth in only State economic area 8. They were of similar relative importance among operators of Class VI farms in State economic areas 2, 4, 5 and B, 7, and 8.

Trends

Data on age of farm operators in Louisiana are available since 1920, and they show a very substantial increase in the relative importance of the aged within this group. Table XXII shows that the aged farm operators have nearly doubled in relative numbers between 1920 and 1950. In 1920, they made up 7.8 per cent of the farm operators as compared to 13.3 per cent in 1950. This increase has been continuous except for the decade 1920 to 1930 during which time a slight decrease occurred in the proportional representation of the aged among farm operators. In 1920, the aged constituted 7.8 per cent of the farm operators, a figure which declined to 7.3 per cent in 1930.

In absolute numbers, the aged have increased continuously since 1920. In that year, 10,435 farm operators were 65 years of age and over. The corresponding figure for 1930 was 11,403 persons; for 1940, 13,948 persons; for 1945, 15,106 persons; and for 1950, 15,277 persons.

On the basis of these observations, one can fairly safely predict that the aged will continue to increase in relative and numerical importance among the farm operators of the state in the immediate future.

TABLE XXII.—Age of Farm Operators, Louisiana, 1920-1950*

Age	1920		1930		1940		1945		1950	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
TOTAL	134,033	100.0	156,569	100.0	143,639	100.0	128,003	100.0	114,691	100.0
Under 25	12,183	9.1	17,824	11.4	10,773	7.5	4,523	3.5	6,006	5.2
25-34	29,473	22.0	33,958	21.7	31,331	21.8	21,179	16.6	18,772	16.4
35-44	35,442	26.4	37,205	23.8	33,115	23.1	33,406	26.1	28,959	25.3
45-54	29,873	22.3	34,516	22.0	31,595	22.0	30,953	24.2	25,959	22.6
55-64	16,626	12.4	21,663	13.8	22,877	15.9	22,836	17.8	19,718	17.2
65 & over	10,436	7.8	11,403	7.3	13,948	9.7	15,106	11.8	15,277	13.3

Source: United States Census of Agriculture, 1950, *Louisiana*, "Farms, Farm Characteristics, Livestock and Products, Crops, Fruits, Values," Vol. 1, Part 24, Table 5.

*The following numbers of persons did not report their ages for the years indicated and are not included in this table: 1,427 in 1920; 4,876 in 1930; 6,368 in 1940; 1,292 in 1945; and 9,331 in 1950.

SUMMARY AND CONCLUSIONS

Among the significant generalizations about the aged farm population and aged farm operators of Louisiana based on the findings of this study are the following:

1. The aged farm population is dominated numerically by men in direct contrast to the aged populations of the other residential areas, which are dominated numerically by women. This is one of the most outstanding differences noted between aged persons on farms as compared to those residing in the urban and nonfarm areas.

2. Approximately three-fifths of the aged persons on farms are native whites and slightly less than two-fifths are Negroes. The remainder are foreign-born whites. Negroes are relatively more numerous among the aged on farms in Louisiana than in the other residential areas.

3. The majority of the aged farm men are married and the largest proportion of the aged farm women are widowed. About one-fourth of the aged farm men also are widowed.

4. More than four-fifths of the aged men on farms are still the heads of the households in which they live. However, considerably less than half of the aged women are wives of the head of the household. Significant proportions of both aged men and women are living with their children. About one-tenth of the men and more than one-fourth of the women are in this category.

5. In general, aged people on farms are a poorly educated group. More than one-fourth of the aged men and almost one-third of the aged women have had no schooling at all. Low educational status characterizes aged persons in each of the residential areas of the state.

6. The majority of the aged persons on farms are no longer part of the labor force. More than half of the aged men and virtually all of the aged women were no longer part of the labor force in 1950.

7. The bulk of the aged farm men not part of the labor force are unable to work. In fact, more than three-fourths of them were in this category in 1950. Of the aged farm women, approximately two-fifths were also unable to work.

8. Aged persons on farms have lower median incomes than their counterparts in the other residential areas. They have larger proportions with low incomes and smaller proportions with high incomes than found among aged persons living in urban and rural-nonfarm areas.

9. The proportion of aged people has almost doubled in the farm population of the state since 1920. A similar increase in the relative numbers of the aged has occurred in the other residential areas.

10. Assuming that the factors responsible for the change in the proportion of aged persons in the farm population are not radically

altered and observing the pattern of aging in other areas of the nation, one can predict that old persons will continue to increase proportionately for the next several decades.

11. More than one-tenth of the farm operators in the state are 65 years of age and over. However, they are not uniformly distributed throughout the state. In some areas elderly individuals constitute significantly larger proportions of the total number of farm operators than in other areas.

12. Aged persons are of approximately equal relative importance among both white and nonwhite farm operators.

13. For the most part, aged farmers are owners of the agricultural enterprises which they operate. In 1950, almost two-thirds of them were classified as full owners. However, considerable variation exists in tenure status of aged farm operators from one State economic area to another. For example, in State economic area 2, more than half of the aged farm operators had status as tenants in 1950.

14. More than half of the aged farm operators are operating cotton farms and another one-fifth of them have farms devoted to the production of livestock other than poultry. Therefore, approximately three-fourths of the aged farm operators have agricultural enterprises producing either cotton or livestock.

15. Although about three-fourths of the aged farmers themselves are operating cotton or livestock farms, relatively they are of most importance among the poultry farmers of the state. In 1950, almost one-fourth of the poultry farms of Louisiana were operated by persons 65 years of age and over.

16. Almost one-half of the aged farm operators had farmsteads of less than 30 acres in 1950. More than two-thirds of them had agricultural enterprises of under 70 acres in size.

17. In general, the data indicate that the proportionate importance of aged farm operators varies considerably among the different sized farm enterprises. By and large, the prevailing pattern seems to be for aged farmers to be disproportionately concentrated among the operators of very small farms (under 10 acres) and of larger farms (70 acres and over). On the other hand, they are underrepresented among the operators of the intermediate sized units of from 10 to 70 acres.

18. Approximately one-half of the farms operated by aged persons are classified as residential farms. Slightly less than one-third of the aged farmers have farms classified as commercial, and slightly less than one-fifth of them have part-time farms.

19. Of the aged individuals with commercial farms, slightly less than half have agricultural enterprises classified as Class VI. This means that they have incomes of between \$250 and \$1,199. Furthermore, another one-third of the commercial farms operated by aged persons are classified as Class V with incomes of \$1,200 to \$2,499 per year. There-

fore, over three-fourths of the aged individuals with commercial farms have farms which are returning to them each year an income of less than \$2,500.

20. Aged farm operators are by far of greatest significance among persons with residential farms. Almost one-fourth of the individuals with residential farms in the state in 1950 were 65 years of age and over. The aged are of least relative importance among persons operating commercial farms, in which they accounted for about one-twelfth of the farmers.

21. Aged farm operators have almost doubled in relative importance among the farmers of Louisiana since 1920. Indications are that this increase in the proportional representation of aged farm operators will continue in the immediate future.

APPENDIX TABLE I.—Persons 65 Years of Age and Over, Total, Urban, Rural-Nonfarm, and Rural-Farm Populations, Louisiana, 1950, by Parishes

Parish	Persons 65 Years of Age and Over					
	Total Population		Urban Population		Rural-Nonfarm Population	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Acadia	2,720	5.8	1,462	6.6	613	6.0
Allen	1,294	6.4	399	7.1	470	6.1
Ascension	1,714	7.7	361	8.7	470	6.1
Assumption	1,398	8.1	...	...	952	9.8
Avoyelles	2,694	7.1	561	6.8	1,314	10.6
Beauregard	1,381	7.8	424	7.3	437	8.1
Bienville	1,677	8.8	...	...	895	9.1
Bossier	2,032	5.1	483	2.9	741	5.4
Caddo	11,966	6.8	8,820	6.6	2,071	7.3
Calcasieu	4,394	4.9	3,091	4.8	949	4.9
Caldwell	883	8.6	...	...	522	8.8
Cameron	372	6.0	...	...	168	4.1
Catahoula	916	7.7	...	...	522	10.8
Claiborne	1,972	7.9	598	7.7	402	7.2
Concordia	1,131	7.9	326	8.5	388	9.2
DeSoto	2,331	9.6	381	8.6	797	10.2
East Baton Rouge	7,481	4.7	5,939	4.4	291	13.0
East Carroll	1,315	8.1	467	11.3	957	6.3
East Feliciana	2,056	10.7	910	13.4	394	9.5
Evangeline	1,512	4.8	315	4.7	767	7.3
Franklin	1,810	6.2	301	8.2	431	11.5
Grant	1,286	9.0	...	...	836	9.1
Iberia	2,424	6.1	1,400	6.6	662	5.4
Iberville	2,307	8.6	513	8.9	1,547	8.7
Jackson	1,104	7.2	207	6.7	629	8.2
Jefferson	4,392	4.2	3,913	4.2	435	4.1
Jefferson Davis	1,720	6.5	847	6.8	517	7.2
Lafayette	2,885	5.0	1,628	4.9	649	6.4
Lafourche	2,289	5.4	607	5.8	1,128	4.9
LaSalle	927	7.3	...	...	660	6.6
Lincoln	1,890	7.3	689	6.6	423	8.8
Livingston	1,160	5.8	...	...	591	5.9

(Continued)

APPENDIX TABLE 1.—(Continued)

Parish	Persons 65 Years of Age and Over					
	Total Population		Urban Population		Rural-Nonfarm Population	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Madison	1,341	7.7	685	8.8	156	9.5
Morehouse	2,057	6.4	722	5.7	501	8.4
Natchitoches	3,071	8.1	779	7.9	1,275	10.4
Orleans	40,700	7.1	40,700	7.1	...	...
Ouachita	4,988	6.7	3,214	6.6	1,319	6.9
Plaquemines	748	5.3	...	...	561	4.8
Pointe Coupee	1,774	8.1	204	7.2	798	10.3
Rapides	6,309	7.0	2,703	6.5	2,684	7.5
Red River	1,051	8.7	...	...	428	10.8
Richland	1,704	6.4	292	9.3	601	9.3
Sabine	1,664	8.0	...	...	997	7.7
St. Bernard	548	4.9	134	5.1	374	4.8
St. Charles	824	6.2	134	4.0	595	6.8
St. Helena	680	7.5	...	...	203	9.1
St. James	1,265	8.2	...	...	865	8.8
St. John	1,029	6.9	270	6.0	630	7.5
St. Landry	4,032	5.1	1,239	6.2	1,237	7.3
St. Martin	1,496	5.7	338	7.3	724	6.6
St. Mary	2,586	7.2	1,181	6.4	971	8.8
St. Tammany	2,292	8.5	727	8.5	1,194	9.3
Tangipahoa	3,711	7.0	1,120	7.5	1,378	7.8
Tensas	1,234	9.5	...	...	575	12.0
Terrebonne	2,355	5.4	944	5.8	979	4.7
Union	1,473	7.7	...	...	808	7.9
Vermilion	2,332	6.3	959	6.9	686	6.4
Vernon	1,614	8.5	338	7.2	608	9.5
Washington	2,158	5.6	957	5.4	464	6.3
Webster	2,383	6.7	882	6.7	851	6.0
West Baton Rouge	867	7.4	180	5.8	335	7.4
West Carroll	1,154	6.7	...	...	524	11.0
West Feliciana	692	6.8	...	...	412	6.5
Winn	1,374	8.5	448	8.0	368	7.9
Louisiana	176,849	6.6	93,822	6.4	47,398	7.4
					35,629	6.3

Source: 1950 United States Census of Population, Louisiana. "General Characteristics." (New Census definitions of residence utilized.)

APPENDIX TABLE II.—White Persons 65 Years of Age and Over, Total, Urban, Rural-Nonfarm and Rural-Farm Populations, Louisiana, 1950, by Parishes

Parish	White Persons 65 Years of Age and Over					
	Total Population		Urban Population		Rural-Nonfarm Population	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Acadia	2,169	5.7	1,055	6.4	534	5.8
Allen	900	6.3	262	6.8	358	6.2
Ascension	974	6.7	212	8.2	412	6.6
Assumption	823	8.2	...	..	529	9.0
Avoyelles	1,923	6.8	381	6.1	961	10.3
Beauregard	1,124	7.6	292	7.2	343	7.9
Bienville	1,034	10.7	...	..	558	10.9
Bossier	904	3.4	334	2.3	280	3.1
Caddo	6,989	6.3	5,490	6.3	1,189	6.1
Calcasieu	3,300	4.8	2,249	4.7	742	4.6
Caldwell	643	8.7	...	..	384	9.2
Cameron	333	5.9	...	..	145	3.9
Catahoula	500	6.5	...	..	276	8.7
Claiborne	1,071	8.8	384	8.0	209	6.1
Concordia	314	5.4	77	5.1	120	5.4
DeSoto	1,135	10.7	251	9.0	359	9.8
East Baton Rouge	4,213	4.0	3,488	3.7	406	5.0
East Carroll	321	5.1	125	7.2	56	6.2
East Feliciana	1,039	13.0	666	14.8	168	8.6
Evangeline	1,242	5.2	272	4.9	624	7.1
Franklin	1,073	5.8	153	7.2	260	9.1
Grant	980	9.1	...	..	651	8.9
Iberia	1,563	5.8	...	6.1	391	5.0
Iberville	938	6.9	302	7.3	506	6.8
Jackson	828	7.6	173	7.2	464	7.4
Jefferson	3,550	4.1	3,204	4.1	304	3.4
Jefferson Davis	1,309	6.4	636	6.6	356	7.0
Lafayette	2,173	5.2	1,165	4.6	544	5.5
Latourche	1,904	5.2	488	5.3	942	4.6
LaSalle	800	7.1	...	..	561	6.4
Lincoln	1,270	8.2	461	6.6	279	7.9
Livingston	1,019	6.0	...	..	508	6.4

(Continued)

APPENDIX TABLE II.—(Continued)

Parish	Total Population				White Persons 65 Years of Age and Over				Rural-Farm Population			
	No.		Per Cent		Urban Population		Rural-Nonfarm Population		No.		Per Cent	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Madison	319	5.4	136	6.3	59	6.2	124	4.4	124	4.4	124	4.4
Morehouse	949	5.7	434	5.2	264	6.5	251	5.9	251	5.9	251	5.9
Natchitoches	1,646	7.8	30,233	7.8	30,233	7.8	556	7.8	556	7.8	556	7.8
Orleans	3,197	6.4	1,921	6.4	1,921	6.4	...	...	...	...	...	...
Ouachita	426	4.9	...	...	...	...	1,010	6.3	266	6.8	266	6.8
Plaquemines	686	6.8	116	6.8	116	6.8	289	4.0	137	9.0	137	9.0
Pointe Coupee	4,046	6.7	1,643	6.3	1,643	6.3	253	6.4	317	7.1	317	7.1
Rapides	514	8.5	...	...	...	...	1,693	6.9	708	7.2	708	7.2
Red River	884	5.6	109	6.8	109	6.8	219	8.9	295	8.2	295	8.2
Richland	1,353	8.2	...	...	...	...	327	7.2	448	4.7	448	4.7
Sabine	425	4.5	132	5.1	132	5.1	767	8.1	586	8.3	586	8.3
St. Bernard	424	4.7	94	3.4	94	3.4	257	4.0	36	6.8	36	6.8
St. Charles	353	8.3	...	...	...	...	267	4.9	63	7.4	63	7.4
St. Helena	569	7.5	...	...	...	...	118	8.6	194	8.0	194	8.0
St. James	497	6.7	161	5.5	161	5.5	375	7.2	78	9.1	78	9.1
St. John	2,172	5.0	758	5.8	758	5.8	799	6.1	615	3.6	615	3.6
St. Landry	984	5.9	204	7.9	204	7.9	501	6.3	279	4.6	279	4.6
St. Martin	1,392	6.3	841	5.7	841	5.7	395	7.3	156	7.9	156	7.9
St. Mary	1,728	9.1	549	9.3	549	9.3	886	10.1	293	6.7	293	6.7
St. Tammany	2,680	7.3	799	7.9	799	7.9	963	8.8	918	5.9	918	5.9
Tangipahoa	308	6.6	...	...	...	...	164	7.7	144	5.8	144	5.8
Tensas	1,615	4.9	714	5.3	714	5.3	633	4.1	268	7.0	268	7.0
Terrebonne	1,069	8.5	...	...	...	...	581	8.5	488	8.6	488	8.6
Union	2,034	6.3	806	6.8	806	6.8	597	6.6	631	5.6	631	5.6
Vermilion	1,382	8.2	213	6.4	213	6.4	532	9.2	637	8.3	637	8.3
Vernon	1,310	5.7	633	5.3	633	5.3	342	3.42	535	5.9	535	5.9
Washington	1,525	6.7	554	6.6	554	6.6	561	5.4	410	10.3	410	10.3
Webster	316	5.7	100	5.1	100	5.1	105	5.3	111	7.1	111	7.1
West Baton Rouge	879	6.2	...	...	...	...	382	10.1	497	4.8	497	4.8
West Carroll	207	7.1	...	...	...	...	123	5.3	84	13.5	84	13.5
West Feliciana	1,026	8.8	304	8.5	304	8.5	266	7.6	456	9.8	456	9.8
Winn	115,656	6.4	64,891	6.3	64,891	6.3	29,110	6.6	21,655	6.5	21,655	6.5
Louisiana												

Source: 1950 United States Census of Population, Louisiana, "General Characteristics," (New Census definitions of residence utilized.)

APPENDIX TABLE III.—Nonwhite Persons 65 Years of Age and Over , Total, Urban, Rural-Nonfarm and Rural-Farm Populations, Louisiana, 1950, by Parishes

Parish	Total Population			Nonwhite Persons 65 Years of Age and Over			Rural-Nonfarm Population			Rural-Farm Population		
	No.		Per Cent	Urban Population		Per Cent	No.		Per Cent	No.		Per Cent
	No.	Per Cent		No.	Per Cent		No.	Per Cent		No.	Per Cent	
Acadia	551	6.1		407	7.1		79	7.5		65	3.0	
Allen	304	6.7		137	7.8		112	5.9		55	6.2	
Ascension	740	9.3		149	7.8		407	10.3		184	7.7	
Assumption	575	8.0		...	...		423	11.1		152	4.5	
Avoyelles	771	7.8		180	8.9		353	11.5		238	4.9	
Beauregard	257	8.5		132	7.7		94	8.8		31	13.2	
Bienville	643	6.8		...	...		337	7.1		306	6.6	
Bossier	1,128	8.1		149	5.9		461	9.5		518	7.9	
Caddo	5,027	7.6		3,330	7.2		882	10.3		815	7.0	
Calcasieu	1,094	5.3		842	5.1		297	5.9		45	6.4	
Caldwell	240	8.2		...	...		138	8.0		102	8.4	
Cameron	39	6.7		...	...		23	6.4		16	7.1	
Catahoula	416	10.0		...	...		246	14.7		170	6.9	
Claiborne	901	7.0		214	7.2		193	9.0		494	6.3	
Concordia	817	9.6		249	10.7		268	13.5		300	7.1	
De Soto	1,196	8.7		130	7.8		438	10.5		628	7.9	
East Baton Rouge	3,268	6.2		2,451	5.7		551	7.9		266	9.9	
East Carroll	994	10.0		342	14.3		235	17.7		417	6.7	
East Feliciana	1,017	9.1		244	10.8		226	10.3		547	8.2	
Evangeline	270	3.6		43	4.1		143	8.6		84	1.7	
Franklin	737	6.8		148	9.7		171	18.8		418	5.0	
Grant	306	8.9		...	...		185	9.8		121	7.7	
Iberia	861	6.6		470	8.0		271	6.0		120	4.6	
Iberville	1,369	10.5		211	13.2		1,041	10.2		117	9.3	
Jackson	276	6.0		34	5.0		165	5.9		77	7.0	
Jefferson	842	5.2		709	4.9		131	7.2		2	4.8	
Jefferson Davis	712	7.2		211	7.3		161	8.0		39	5.0	
Lafayette	712	4.5		463	5.6		105	6.1		144	2.5	
Lafourche	385	6.8		119	8.5		186	6.6		80	5.5	
La Salle	127	8.9		...	...		99	7.7		28	20.6	
Lincoln	620	6.0		228	6.7		144	4.7		248	6.4	
Livingston	141	4.8		...	...		83	4.1		58	6.1	

(Continued)

APPENDIX TABLE III.—(Continued)

Parish	Nonwhite Persons 65 Years of Age and Over					
	Total Population		Urban Population		Rural-Nonfarm Population	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Madison	1,022	8.8	549	9.8	97	13.9
Morehouse	1,108	7.2	288	6.5	237	12.3
Natchitoches	1,425	8.3	392	10.2	572	12.8
Orleans	10,467	5.7	10,467	5.7	...	...
Ouachita	1,791	7.3	1,323	7.0	309	9.7
Plaquemines	322	5.8	...	...	272	6.0
Pointe Coupee	1,088	9.3	88	7.9	545	5.1
Rapides	2,263	7.5	1,060	7.0	989	14.2
Red River	537	8.9	...	...	209	9.0
Richland	820	7.5	183	12.0	274	13.8
Sabine	311	7.2	...	...	230	14.1
St. Bernard	123	7.6	2	3.3	117	6.7
St. Charles	400	9.2	40	6.4	328	7.8
St. Helena	327	6.8	...	...	85	9.9
St. James	696	9.0	...	...	490	6.2
St. John	532	7.2	109	7.1	372	6.7
St. Landry	1,860	5.3	481	7.2	758	10.5
St. Martin	512	5.3	134	6.6	223	7.9
St. Mary	1,194	8.7	340	8.9	576	9.3
St. Tammany	564	7.1	178	6.7	308	10.2
Tangipahoa	1,031	6.2	321	6.6	415	7.5
Tensas	926	10.8	...	...	411	6.3
Terrebonne	740	6.9	230	8.4	346	15.4
Union	404	6.1	...	...	227	6.4
Vermilion	298	6.3	153	7.7	89	6.7
Vernon	232	10.5	125	9.2	76	5.8
Washington	648	5.4	324	5.6	122	13.1
Webster	858	6.6	328	6.8	290	5.7
West Baton Rouge	551	8.8	80	7.0	230	7.7
West Carroll	275	8.8	...	...	142	9.0
West Feliciana	485	6.7	...	...	289	14.4
Winn	348	7.9	144	7.0	102	7.2
Louisiana	61,193	6.9	28,931	6.4	18,288	8.5
						9.0
					13,974	6.0

Source: 1950 United States Census of Population, Louisiana, "General Characteristics." (New Census definitions of residence utilized.)

APPENDIX TABLE IV.—Sex Ratios Among the Aged, Total, White, and Nonwhite Populations, by Parish, Louisiana, 1950

Parish	Total			White			Nonwhite		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Acadia	1,361	1,359	100.2	1,086	1,083	100.3	275	276	99.6
Allen	617	587	105.1	462	438	105.5	155	149	104.0
Ascension	797	797	100.0	446	528	84.5	351	389	90.2
Assumption	629	769	81.8	365	458	79.7	264	311	84.9
Avoyelles	1,334	1,360	98.1	945	978	96.6	389	382	101.8
Beauregard	726	655	110.8	593	531	111.7	133	124	107.3
Bienville	856	821	104.3	514	520	98.8	342	301	113.6
Bossier	1,027	1,005	102.2	462	442	104.5	565	563	100.4
Caddo	5,416	6,350	82.7	3,105	3,834	81.0	2,311	2,716	85.1
Caldwell	2,159	2,235	96.6	1,585	1,715	92.4	574	520	110.4
Caldwell	467	416	112.3	339	304	111.5	128	112	114.3
Catahoula	191	181	105.5	168	165	101.8	23	16	143.8
Clatborne	488	428	114.0	278	222	125.2	210	206	101.9
Concordia	980	992	98.8	534	537	99.4	446	455	98.0
De Soto	583	548	106.4	181	133	136.1	402	415	96.9
East Baton Rouge	1,155	1,176	98.2	559	576	97.0	596	600	99.3
East Carroll	3,157	4,284	74.6	1,709	2,504	68.3	1,488	1,780	83.6
East Feliciana	653	662	98.6	175	146	119.9	478	516	92.6
Evangeline	973	1,083	89.8	460	579	79.4	513	504	101.8
Franklin	787	725	108.6	641	601	106.7	146	124	117.7
Grant	964	846	113.9	576	497	115.9	388	349	111.2
Grant	655	631	103.8	512	468	109.4	143	163	87.7
Iberia	1,118	1,306	85.6	717	846	84.8	401	460	87.2
Iberville	1,085	1,222	88.8	467	471	99.2	618	751	82.3
Jackson	556	548	101.5	421	407	103.4	135	141	95.7
Jefferson	1,985	2,407	82.5	1,378	1,972	80.0	407	435	93.6
Jefferson Davis	856	864	99.1	628	681	92.2	228	183	124.6
Lafayette	1,279	1,606	79.6	930	1,243	74.8	349	363	96.1
Lafourche	1,058	1,231	85.9	866	1,038	83.4	192	193	99.5
La Salle	491	436	112.6	424	376	112.8	67	60	111.7
Lincoln	896	994	90.1	589	681	86.5	307	313	98.1
Livingston	647	513	126.1	576	443	130.0	71	70	102.8

(Continued)

APPENDIX TABLE IV.—(Continued)

Parish	Total			White			Nonwhite		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Madison	683	658	103.8	165	154	107.1	518	504	102.8
Morehouse	1,069	988	108.2	487	462	105.4	582	526	110.6
Natchitoches	1,548	1,523	101.6	835	811	103.0	713	712	100.1
Orleans	16,077	24,623	65.3	11,813	18,420	64.1	4,264	6,203	68.7
Ouachita	2,369	2,619	90.5	1,531	1,666	91.9	838	953	87.9
Plaquemines	413	335	123.3	235	191	123.0	178	144	123.6
Pointe Coupee	867	907	95.6	331	355	93.2	536	552	97.1
Rapides	3,088	3,221	95.9	1,964	2,082	94.3	1,124	1,139	98.7
Red River	534	517	103.3	272	242	112.4	262	275	95.3
Richland	889	815	109.1	477	407	117.2	412	408	101.0
Sabine	883	781	113.1	707	646	109.4	176	135	130.4
St. Bernard	297	251	118.3	232	193	120.2	65	58	112.1
St. Charles	381	443	86.0	199	225	88.4	182	218	83.5
St. Helena	370	310	119.4	183	170	107.7	187	140	133.6
St. James	575	690	83.3	236	333	70.9	339	357	95.0
St. John the Baptist	489	540	90.6	238	259	91.9	251	281	89.3
St. Landry	1,916	2,116	90.5	996	1,176	84.7	920	940	97.9
St. Martin	706	790	89.4	442	542	81.5	264	248	106.5
St. Mary	1,230	1,356	90.7	1,356	736	89.1	574	620	92.6
St. Tammany	1,128	1,164	96.9	835	893	93.5	271	293	108.1
Tangipahoa	1,890	1,821	103.8	1,350	1,330	101.5	540	491	110.0
Tensas	611	623	98.1	169	139	121.6	442	484	91.3
Terrebonne	1,126	1,229	91.6	767	848	90.4	359	381	94.2
Union	754	719	104.9	540	529	102.1	214	190	112.6
Vermilion	1,136	1,196	95.0	989	1,045	94.6	147	151	97.4
Vernon	883	731	120.8	753	629	119.7	130	102	127.5
Washington	1,151	1,007	114.3	781	729	107.1	370	278	133.1
Webster	1,217	1,166	104.4	774	751	103.1	443	415	106.7
West Baton Rouge	441	426	103.5	142	174	81.6	299	252	118.7
West Carroll	635	519	122.4	490	389	126.0	145	130	111.5
West Feliciana	346	346	100.0	108	99	109.1	238	247	96.4
Winn	742	632	117.4	553	473	116.9	189	159	118.9

Source: United States Census, 1950, Louisiana, "Characteristics of the Population," Vol. II, Part 18, Table 41.

APPENDIX TABLE V.—Sex Ratios Among the Aged, Urban, Rural-Nonfarm and Rural-Farm Populations, by Parish, Louisiana, 1950*

Parish	Urban			Rural-Nonfarm			Rural-Farm		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Acadia	675	787	85.8	324	289	112.1	362	283	127.9
Allen	191	208	91.8	231	239	96.7	195	140	139.3
Ascension	132	229	57.6	378	441	85.7	287	247	116.2
Assumption	...	...	...	410	542	75.6	219	227	96.5
Avoyelles	246	315	78.1	615	699	88.0	473	346	136.7
Beauregard	199	225	88.4	236	201	117.4	291	229	127.1
Bienville	...	...	...	425	470	90.4	431	351	122.8
Bossier	209	274	76.3	360	381	94.5	458	350	130.9
Caddo	3,771	5,049	74.7	1,038	1,033	100.5	607	468	129.7
Calcasieu	1,442	1,649	87.4	512	437	117.2	205	149	137.6
Caldwell	...	...	...	264	258	102.3	203	158	128.5
Cameron	...	...	...	87	81	107.4	104	100	104.0
Catahoula	...	...	...	254	268	94.8	234	160	146.3
Clatborne	250	348	71.8	204	198	103.0	526	446	117.9
Concordia	155	171	90.6	202	186	108.6	226	191	118.3
De Soto	155	226	68.6	388	409	94.9	612	541	113.1
East Baton Rouge	2,402	3,537	67.9	475	482	98.5	320	265	120.8
East Carroll	197	270	73.0	142	149	95.3	314	243	129.2
East Feliciana	406	504	80.6	157	237	66.2	410	342	119.9
Evangeline	136	179	76.0	402	365	110.1	249	181	137.6
Franklin	139	162	85.8	214	217	98.6	611	467	130.8
Grant	...	...	...	408	428	95.3	247	203	121.7
Iberia	603	797	75.7	325	337	96.4	190	172	110.5
Iberville	217	296	73.3	728	819	88.9	140	107	130.8
Jackson	96	111	86.5	302	327	92.4	158	110	143.6
Jefferson	1,730	2,183	79.2	228	207	110.1	27	17	158.8
Jefferson Davis	399	448	89.1	261	256	102.0	196	160	122.5
Lafayette	696	932	74.7	292	357	81.8	291	317	91.8
Lafourche	253	354	71.5	509	619	82.2	296	258	114.7
La Salle	...	...	...	342	318	107.5	149	118	126.3
Lincoln	286	403	71.0	194	229	84.7	416	362	114.9
Livingston	...	...	...	302	289	104.5	345	224	154.0

(Continued)

APPENDIX TABLE V.—(Continued)

Parish	Urban			Rural-Nonfarm			Rural-Farm		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Madison	314	371	84.6	94	62	151.6	275	225	122.2
Morehouse	340	382	89.0	238	263	90.5	491	343	143.1
Natchitoches	330	449	73.5	647	628	103.0	571	446	128.0
Orleans	16,077	24,623	65.3	...	...	...	...	...	...
Quachita	1,462	1,782	82.0	668	651	102.6	239	186	128.5
Plaquemines	...	...	...	301	260	115.8	112	75	149.3
Pointe Coupee	84	120	70.0	384	414	92.8	399	373	107.0
Rapides	1,204	1,499	80.3	1,375	1,309	105.0	509	413	123.2
Red River	...	...	...	207	221	93.7	327	296	110.5
Richland	125	167	74.9	304	297	102.4	460	351	131.1
Sabine	...	...	...	509	488	104.3	374	293	127.6
St. Bernard	59	75	78.7	215	159	135.2	23	17	135.3
St. Charles	57	77	74.0	267	328	81.4	57	38	150.0
St. Helena	...	...	...	94	109	86.2	276	201	137.3
St. James	...	...	...	387	478	81.0	188	212	88.7
St. John the Baptist	136	134	101.5	291	339	85.8	62	67	92.5
St. Landry	537	702	76.5	744	813	91.5	635	601	105.7
St. Martin	150	188	79.8	337	387	87.1	219	215	101.9
St. Mary	528	653	80.9	470	501	93.8	232	202	114.9
St. Tammany	301	426	70.7	616	578	106.6	211	160	131.9
Tangipahoa	499	621	80.4	691	687	100.6	700	513	136.5
Tensas	...	...	...	264	311	84.9	347	312	111.2
Terrebonne	404	540	74.8	481	498	96.6	241	191	126.2
Union	...	...	...	386	422	91.5	368	297	123.9
Vermilion	448	511	87.7	329	357	92.2	359	328	109.5
Vernon	167	171	97.7	316	292	108.2	400	268	149.3
Washington	492	465	105.8	240	224	107.1	419	318	131.8
Webster	412	470	87.7	431	420	102.6	374	276	135.5
West Baton Rouge	84	96	87.5	169	166	101.8	188	164	114.6
West Carroll	...	...	...	270	254	106.3	365	265	137.7
West Feliciana	...	...	...	198	214	92.5	148	132	112.1
Winn	210	238	88.2	197	171	115.2	335	223	150.2

Source: United States Census, 1950, *Louisiana*, "Characteristics of the Population," Vol. II, Part 18, Tables 41, 48, 49.

*New definitions of residence are used in this table.

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THE MANY

Louisianans

Alvin L. Bertrand

Rural Social Areas
and
Cultural Islands

in No. 496

June 1955

LOUISIANA STATE UNIVERSITY
AND
CULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

J. N. EFFERSON, *Director*



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The Many Louisianas:

A Study of Rural Social Areas and Cultural Islands

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INTRODUCTION

Persons in charge of administering programs and conducting research in rural areas have repeatedly faced a fundamental problem. This problem is directly related to the cultural diversity of rural populations. It comes to light in two ways. First, it is recognized in the inability of county agents and others to successfully use the same techniques of disseminating information with all groups. Anyone familiar with the situation in states such as Louisiana can appreciate how a certain approach might be quite effective in one part of the state but be completely ineffective and even violently rejected in another area. Secondly, the problem stemming from cultural diversity is seen in the great deal of time and effort spent by researchers in the determination of areas suitable for representative sampling. In this connection, it is evident that conclusions based on inadequate samples lose much of their applicability.

The above problems prompted the decision to delineate and describe areas of socio-cultural homogeneity in rural Louisiana. It is felt that a delineation of this sort will be extremely useful to rural sociologists and agricultural economists as well as to many others. In fact, the inevitable conclusion that the human element must be considered in any action-type agricultural program makes such a tool of help in many technical fields. For example, such specialists as agronomists, soil conservationists, and foresters can benefit in a great number of ways from a knowledge of the rural cultural landscape.

The decision to delineate areas in which there is a high degree of similarity with respect to rural social organization and culture follows the determination of homogeneous areas for other purposes. Professionals in various agricultural and allied fields have delineated geographic areas within which they recommend particular practices. Thus there are maps showing such things as soil types, topography, temperature, and rainfall, to name a few. The specific objectives for the determination of rural social areas are listed below.

Objectives

The major objectives of the present study may be listed as follows: The first purpose was to ascertain and describe valid criteria for determining rural social areas in Louisiana and to use these criteria in the

delineation and mapping of homogeneous areas in the state. This was a major undertaking, and the procedure used is explained in the section on methodology and in the appendix.

A second purpose was to compare the rural areas delineated with the State Economic Areas of Louisiana utilized by the Seventeenth Decennial Census. The latter were an innovation in census reporting and tabulation in order to present an intermediate level of data between the county and state levels. The object in mind in comparing the areas delineated with the State Economic Areas was to determine whether or not the Census areas were completely valid for the state of Louisiana.

The third objective was to analyze the association of the rural social areas to the type-farming areas of the state. In this connection several studies have shown that the nature of the farm enterprises is tremendously important in conditioning the culture of rural groups. This seemed a hypothesis worth testing in the present study. It may be noted that an up-to-date type-farming map is a by-product of this objective. The absence of a recent detailed map of this kind made it necessary to construct one.

A final undertaking of the study was concerned with a different type of cultural delineation. This was the location of the zone of transition between French, Catholic south Louisiana and Anglo-Saxon, Protestant north Louisiana and the major cultural islands of the state. Such research has long been overdue. It will be of great utility to persons interested in the cultural landscape of the state as well as aid in the training of Agricultural Extensionists and other personnel. In the latter regard, invariably, isolated cultural groups represent special problems in terms of approach and education.

Methodology

The task of delineating rural social areas is one which falls under the heading of a problem of social or human ecology. In other words, it deals with the spatial aspects of human behavior. Subregions of the sort proposed have usually been delineated on the basis of biophysical factors expressed in terms of geographic characteristics and natural resources. However, recent studies have shown the socio-cultural approach to be more realistic.¹ These latter studies provided the point of departure for the methodology used in the present study.² Several refinements have been attempted and it is hoped that these will represent a research contribution.

¹A description of this approach is found in Charles E. Lively and Cecil L. Gregory, "The Rural Socio-Cultural Area as a Field for Social Research," *Rural Sociology*, XIX (1954), 21-31.

²See, for example, C. E. Lively and C. L. Gregory, *Rural Social Areas in Missouri*, Columbia: Missouri Agricultural Experiment Station Research Bulletin 305, 1939; C. E. Lively and C. L. Gregory, *Rural Social Areas in Missouri*, Columbia: Missouri Agricultural Experiment Station Research Bulletin 414, 1948; and Harold C. Bennett, *Rural Social Areas of Louisiana*, unpublished Master's thesis, Department of Sociology, Louisiana State University, 1952.

The first step in the delineational procedure was the collection and tabulation of all but the most unreliable, duplicatory and irrelevant data available by parishes. In this respect, it is recognized that variation exists below the parish level and that many times a regional line should bisect a parish. However, the paucity of data for minor civil divisions necessitated the use of parish data. Altogether, information was obtained on some 42 variables or factors. Table I shows these factors and groups them according to general headings. The most fruitful source of data was the Seventeenth Decennial Census reports. However, other sources were utilized for particular types of information and these are shown in Table I.

The second step involved the systematic combination of related variables into composite indexes. This was done not only to reduce the number but to obtain a list of variables measuring different characteristics. The original 42 variables were reduced to 23 in this manner. Combinations made are shown in Table I.

TABLE I.—Classification of the 42 Factors Used in the Determination of Socio-Cultural Scores Showing the Variables Combined into Composite Indexes*

POPULATION FACTORS.

1. Total population per square mile.
2. Rural population per square mile.
3. Per cent of population classified as rural farm.
4. Per cent of population classified as rural nonfarm.
5. Age index (Summation of the rank orders of the factors listed below).
 - Percentage of rural farm population 15-44 years of age.
 - percentage of rural farm population 45-64 years of age.
 - Percentage of rural farm population 65 years of age and over.
 - percentage of rural nonfarm population 15-44 years of age.
 - percentage of rural nonfarm population 45-64 years of age.
 - percentage of rural nonfarm population 65 years of age and over.
6. Race index (Summation of the rank orders of the factors listed below).
 - Percentage of Negroes in the rural nonfarm population.
 - Percentage of Negroes in the rural farm population.
7. Dependency ratio (Summation of the rank orders of the factors listed below).
 - Dependency ratio rural nonfarm population.
 - Dependency ratio rural farm population.
8. Fertility ratio of total population.
9. Fertility ratio of the rural nonfarm population.
10. Fertility ratio of the rural farm population.

LEVEL OF LIVING FACTORS.

11. Rural nonfarm level of living (Summation of the rank orders of the factors listed below).
 - Percentage of rural nonfarm dwellings with electricity.
 - Percentage of rural nonfarm dwellings with running water.
 - Percentage of rural nonfarm dwellings with flush toilets.
 - Median number of persons per room in rural nonfarm dwellings.
 - Percentage of rural nonfarm dwellings with radios.
 - Percentage of rural nonfarm dwellings with mechanical or ice refrigeration.
12. Rural farm level of living (Summation of the rank orders of the factors listed below).
 - Percentage of rural farm dwellings with electricity.
 - Percentage of rural farm dwellings with running water.

- Percentage of rural farm dwellings with flush toilets.
- Median number of persons per room in rural farm dwellings.
- Percentage of rural farm dwellings with radios.
- Percentage of rural farm dwellings with mechanical or ice refrigeration.

SCHOOL AND EDUCATION FACTORS.

- 13. School expenditures per parish per student.
- 14. Number of students per teacher in white schools.
- 15. Number of students per teacher in Negro schools.

HEALTH FACTORS.

- 16. White infant mortality.
- 17. Negro infant mortality.
- 18. Doctor and dentist index (Summation of the rank orders of the factors listed below).
- Number of doctors per 10,000 persons (adjusted to 100).
- Number of dentists per 10,000 persons (adjusted to 100).

AGRICULTURAL FACTORS.

- 19. Value of all farm products sold.
- 20. Proportion of land in farms.
- 21. Percentage of tenancy.
- 22. Average size of farms.
- 23. Farm value index (Summation of the rank orders of the factors listed below).
- Average value of farms.
- Average per acre value of land in farms.

*The data used are based upon tabulations for Louisiana from the Seventeenth Decennial Census of the Population of the United States with the following exceptions: The statistics on school expenditures and pupils per teacher is from *One Hundred First Annual Report, State Department of Education*, Baton Rouge: State Department of Education Bulletin No. 714, 1950. The information on doctors and dentists is from Paul H. Price and Homer L. Hitt, *The Availability of Medical Personnel in Rural Louisiana*, Baton Rouge: Louisiana Agricultural Experiment Station Bulletin No. 459, 1951. All data are for 1950 except the number of dentists per 10,000 persons, which is for 1948.

The computation of coefficients of correlation between each of the factors or variables was the third step in the procedure. This was done after each variable had been converted into a Sten score. The Sten scoring system, developed by Canfield,³ is a technique for converting raw data to continuous single digit form for computing Pearson product-moment correlations. This methodology is fully explained in the appendix.

The fourth step was the development of an equation, properly weighted, for accurately measuring the rank order of parishes on the basis of socio-cultural variables. The procedure used represents a departure from conventional methods and is explained in detail in the appendix. In this step the original 23 factors were reduced to seven highly significant non-duplicatory factors. The significance of these factors as indicators of socio-cultural homogeneity is discussed in the section which follows.

The next step in the delineational procedure was the use of the socio-cultural scores determined above in the preparation of six maps, each based on a different set of class intervals. This procedure was designed to do two things. The first was the elimination of the bias of a particular grouping in the determination of homogeneous areas. The second was the location of persistent core areas to indicate the presence of cultural homogeneity. This procedure showed clearly which parishes

³Canfield, A. A., "The 'Sten' Scale—A Modified C—Scale," *Educational and Psychological Measurement*, XI: 12 (1951), 295-298.

clung together on the basis of socio-cultural likeness and provided the basis for the delineation shown in Figure 1.

One further step remained after the location of core areas. This was the assignment of the fringe and deviant parishes to core areas. In the latter instance contiguity was the deciding factor. The fringe parishes obviously represented zones of transition with more than the usual cultural diversity and had to be carefully studied before assignment to a core area. Thus the procedure followed had to be arbitrary to a certain extent. First, a careful inspection of the type-farming characteristics of the deviant parishes was made. Next, this information was supplemented with a field trip to compare the way of life within the parish with that of its neighbors. In all cases the greater similarity of a given parish to a given core area became evident in the above analysis. The specific characteristics accounting for each assignment are mentioned in the descriptions of the individual areas.

THE IMPORTANT DETERMINANTS OF SOCIO-CULTURAL HOMOGENEITY

As mentioned, some seven factors were retained as significant measures of homogeneity. These included: (1) school expenditures per parish per student, (2) proportion of land in farms, (3) age index, (4) race index, (5) the level of living of the rural nonfarm population, (6) the level of living of the rural farm population, and (7) the fertility ratio of the rural farm population. A brief discussion of each factor may help to clarify its contribution to the delineation of rural social areas.

School Expenditures per Student

Considering first the expenditures in each parish for schools, at least two characteristics are indicated. First, relative economic position is generally reflected in school expenditure. Thus the more wealthy parishes would tend to stand out in this respect. Secondly, attitude toward education is shown in the support of taxes, bond issues, etc. for school support and in the willingness to support private education. Indirectly, expenditures for education measure the quality of education being offered. In other words, it generally holds that the more money spent per pupil, the better facilities and teachers there are available. All of the above obviously contribute to the cultural complex of a people.

Proportion of Land in Farms

The proportion of land in farms directly indicates the prevailing mode of earning a livelihood. In some parishes the rural population is almost entirely dependent on work off the farm for a livelihood, and represents a nonfarm populace. In other areas the land is mostly in forests instead of farms, with rural inhabitants living on small farms at a near-subsistence level. The remaining areas have a greater or lesser degree of bona fide farming activity. How important occupation is in determining cultural orientation has been shown many times. The whole person-

ality complex of ruralites tends to be differentiated from urbanites on the basis of occupational characteristics. In the light of the above, it is quite realistic to assume that the relative extent of land in farms contributes to degree of homogeneity.

Age Composition

Age also has a close tie to cultural variability. Young populations tend to be less conservative than older populations and have different tastes as consumers. Older populations are generally more concerned with welfare programs, whereas younger groups tend to think more in terms of lower taxes. Thus differences in age structure logically contribute to a determination of cultural diversity. The age index was derived through a summation of the rank orders of percentages of the rural farm and rural nonfarm populations 15 to 44 years of age, 45 to 64 years of age, and 65 years of age and over.

Race Composition

Race, in a state in which Negroes comprise one-third of the population, is a tremendously important phenomenon. This is especially true because the Negroes are concentrated in certain rural areas. Culture is affected in so many ways in a bi-racial situation that there is no need to elaborate at the present time. Suffice it to say that it would have been quite surprising if such an index had not contributed significantly to the determination of cultural differences. The race index used included a summation of the rank order of parishes on the basis of the percentages of Negroes in rural farm and rural nonfarm populations.

Level of Living

In all previous studies of the nature of the present one known to the writer, level or plane of living has been isolated as the prime or one of the prime indicators of cultural variability. This fact, in itself, confirms the validity of the methodology of the present study. Level of living was determined for this study by summing the rank order of parishes on the basis of the percentage of dwellings with electricity, running water, flush toilets, persons per room, radios, and mechanical or ice refrigeration. Rural nonfarm and rural farm levels of living were computed separately for two reasons. First, there are significant differences in consumption levels between the two groups. Secondly, some parishes have a greater proportion of one or the other population. Either of the above would tend to influence the true picture in certain parishes if rural nonfarm and rural farm levels were lumped together. The fact that both the rural nonfarm and rural farm indexes of level of living were retained through systematic statistical elimination indicates the importance of such measures and validates the decision to include them separately. Even the most casual observer can easily detect the influence of level of living on cultural homogeneity.

Fertility

Using the same logic mentioned above, the fertility ratios (the ratio of the number of children under five years to the number of women 15-45 years) of the rural farm and rural nonfarm populations were computed as independent factors. The reasoning for this decision was that there is more difference between rural farm populations in fertility than in rural nonfarm populations. In Louisiana this phenomenon is related to religious diversity. The rural people in south Louisiana are predominantly Catholic and generally have a higher birth rate than the Protestant inhabitants of rural north Louisiana. The rural nonfarm areas tend to be more cosmopolitan and do not seem to feel the impact of religious culture as much as the rural areas. The decision to keep rural farm and rural nonfarm fertility separated appears to have been a sound one in that the latter was eliminated as a major determinant of cultural variance. The fertility of the rural farm population certainly is an important variant with cultural ties.

Conclusion

In concluding this section it is the belief of the writer that the above represent extremely valid criteria for differentiating or delineating rural areas in Louisiana. Their use outside the state without checking would not be advisable because cultural characteristics vary between states as well as within states. Thus one would need to know what factors, such as race, would or would not have major significance in a given locality. Nevertheless the nature of the above criteria indicates the type of variables which would be useful in delineating rural regions in other states.

THE RURAL SOCIAL AREAS OF LOUISIANA

The rural areas of Louisiana having socio-cultural homogeneity were delineated as previously explained and are described in the sections which follow. They are shown in Figure 1. Area variations in socio-cultural characteristics are shown in Table II.

Area I, The Red River Delta Area

Area I is located along the Red River and extends from the northeastern tip of Louisiana to the central part of the state. It includes the parishes of Caddo, Bossier, DeSoto, Red River, Natchitoches, and Rapides. In describing Area I, two of its characteristics must be pointed out as detracting from its homogeneity. The first is that two of the included parishes have fairly large urban centers which influence the surrounding rural areas. The second is the fact that the rich alluvial lands of the Red River Delta make up only a small portion of the parishes but account in large part for the homogeneity of the area. The parts of the parishes in Area I outside the Red River Delta are more characteristic of the adjacent Areas IV and V.

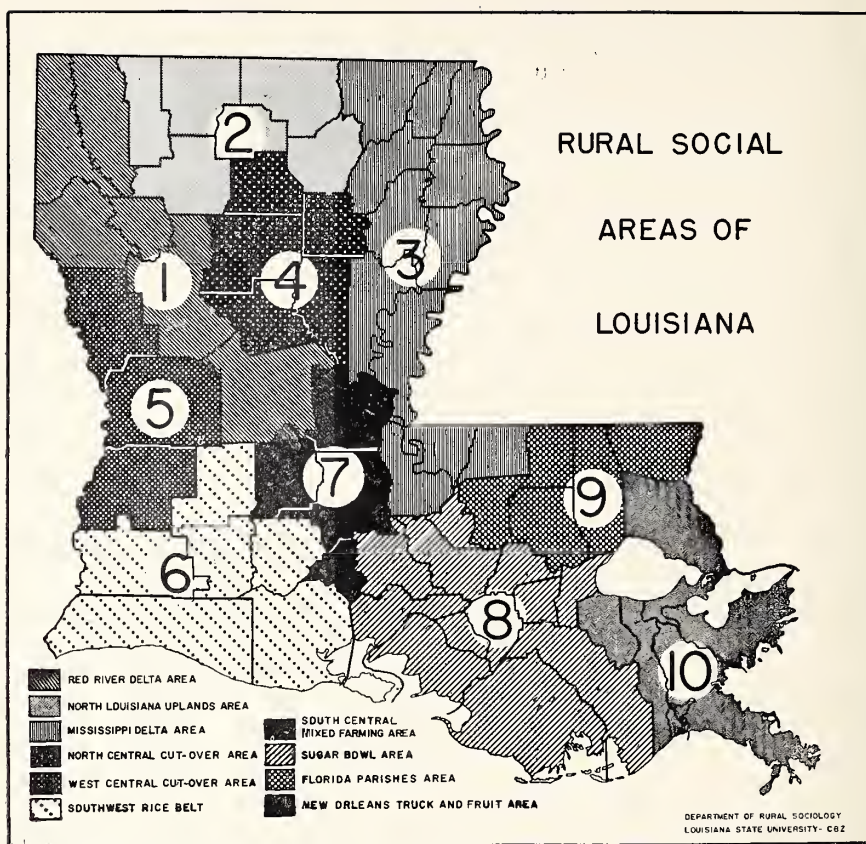


FIGURE I.—Location of the ten rural social areas of Louisiana delineated.

Particular characteristics of Area I are: (1) a high proportion of Negroes (it is only exceeded in this respect by the Mississippi Delta), (2) a high rate of tenancy, (3) a relatively low average level of living, (4) a high infant mortality rate, and (5) a relatively high fertility ratio.

In general, Area I may be described as a delta cotton-livestock area. The farms in the delta proper are large and can be termed plantations for the most part. The characteristics enumerated above are typical of this kind of operation. The owners of the plantations are highly specialized businessmen who use the latest innovations in their operations. They employ a large number of workers or "croppers" to do the manual labor, and this accounts for the large proportion of Negroes in the area. Although there is no recognizable middle class in the delta portion of Area I, such a class may be found in the cut-over flat and hilly lands included in this area. The latter influence the characteristics of the area to a considerable extent.

TABLE II.—Socio-Cultural Variations among the Rural Social Areas of Louisiana

VARIABLES	Area I	Area II	Area III	Area IV	Area V	Area VI	Area VII	Area VIII	Area IX	Area X
Per cent of population rural nonfarm	31.6	36.9	27.0	58.0	42.3	34.8	28.0	49.6	27.7	55.7
Per cent of population rural farm	34.9	35.0	56.0	31.9	39.2	27.3	41.2	27.0	41.1	11.3
Percentage of tenancy	44.7	34.4	61.4	17.8	11.8	29.9	51.9	28.5	18.4	17.0
Value of all farm products sold (thousands of dollars)	5,638	2,443	4,300	873	1,319	7,174	7,619	3,506	3,410	1,111
Rural farm level of living index	113.5	208.3	110.7	222.7	212.8	266.0	125.6	191.8	259.4	325.0
Rural nonfarm level of living index	183.1	254.0	143.9	231.2	138.6	217.0	184.2	165.3	198.2	273.0
Proportion of land in farms	46.4	47.9	61.6	18.5	19.4	52.0	55.2	37.3	42.8	16.0
Average size of farms	91.8	102.5	111.1	65.7	77.2	172.7	48.5	185.0	62.1	121.9
Farm value index	60	43	57	35	18	95	84	105	67	111
Race index	92.0	82.0	103.0	42.0	19.0	26.0	55.0	79.8	65.0	50.0
Age index	196.9	211.6	179.7	235.4	221.4	193.1	172.4	170.1	174.4	223.1
Doctors and dentist index	74.5	92.8	47.3	61.6	46.4	89.0	74.4	66.1	66.0	40.2
Rural population per square mile	31.7	29.9	29.4	18.9	13.9	20.8	55.8	40.2	36.2	23.0
Total population per square mile	67.2	51.4	35.1	21.1	16.7	42.4	95.7	54.1	104.1	73.2
White infant mortality rate	32.6	21.6	26.0	19.7	33.3	29.1	28.0	29.3	19.1	23.0
Negro infant mortality rate	57.6	50.1	51.3	41.2	48.9	62.3	65.2	60.2	19.1	23.0
No. of Negro students per teacher	32.3	30.6	35.2	25.9	29.3	36.1	54.9	46.5	37.8	36.9
No. of white students per teacher	26.8	24.2	25.9	24.4	25.3	27.5	31.8	31.8	27.8	31.9
Rural nonfarm fertility ratio	618.5	570.7	643.5	599.1	601.4	626.8	617.5	697.7	675.0	639.3
Rural farm fertility ratio	684.2	599.4	746.3	578.3	570.2	565.3	670.2	719.0	636.9	555.5
Dependency ratio	83.0	50.0	89.3	53.0	70.1	34.1	56.0	85.1	66.2	27.0
School expenditures per student (dollars)	196.84	235.66	166.96	215.59	216.73	211.69	173.92	169.87	200.05	201.60

Area II, The North Louisiana Uplands

Area II is composed of six northern Louisiana parishes, and is commonly called the North Louisiana Uplands. This name is derived from the hilly, rolling terrain common in the area. Area II includes Webster, Claiborne, Union, Lincoln, Bienville, and Ouachita parishes.

Cotton is by far the most important crop in this area, with no parish having less than 10,000 acres planted in this crop in 1950. Beef cattle, dairying, and poultry farming are important supplementary farm enterprises. Income is also boosted by considerable sale of forest products and work in forest products industries. In this connection, many farmers are better classified as part-time operators. Some fruit and truck crops, especially peaches and watermelons, are also found in this area.

The farms in Area II are family size for the most part and are owner operated to a greater extent than the farms in Areas I and III on either side. Despite the fact that the soil in Area II is not especially fertile, the level of living is relatively high, as is the educational level. In the latter connection, it is significant that the school expenditure per student is highest of all areas in the state while the number of students per teacher is among the lowest. Interestingly, the fertility ratio of the rural population is relatively low in Area II. This is especially significant when the fact that it has a relatively high proportion of Negroes (third highest of the areas) is considered.

The term Yeoman farmer has been used to characterize the inhabitants of this area. They are a hardy, independent, individualistic, God-fearing people who tend to be somewhat conservative in their approach to new ideas or practices. Social stratification is not pronounced in the area.

Area III, The Mississippi Delta Area

This area is one which, historically, has been associated with the production of cotton on large plantations. It includes the largest number of parishes of any of the areas and is one of the most homogeneous. It begins in the northeastern part of the state and extends along the Mississippi River to central Louisiana. The twelve parishes in this area are Morehouse, West Carroll, East Carroll, Franklin, Madison, Richland, Catahoula, Tensas, Concordia, Pointe Coupee, East Feliciana, and West Feliciana.

The outstanding characteristics of Area III can be summarized as follows. Its agriculture is centered in cotton and beef cattle, with hay and soybeans figuring prominently as supplementary enterprises. Traditionally, it has been the home of thousands of Negro sharecroppers. Today, despite the fact that there has been a phenomenal swing to mechanization, it still has the largest percentage of Negroes of any area. In view of this fact, it is not surprising that this area has the highest percentage of tenancy of any area.

Area III also has the highest percentage of its population classified as rural farm, and the lowest percentage classified as rural nonfarm of

any area. In this regard, there is not one major city in the whole area, and it has an extremely low density of population. A phenomenon related to the above is the largest proportion of lands in farms of all areas. The rural inhabitants of Area III have a lower level of living than all but one other area (Area V), and an extremely low educational level. Both the fertility and dependency ratios of the area are the highest for the ten areas delineated. Area III, then, is a region of highly commercial farms, with extremes of social stratification. In many ways it reflects its historic association with cotton culture and Ante Bellum life.

Area IV, The North Central Louisiana Cut-Over Area

Areas IV and V could very well be included in one area, except for contiguity. Their physical and socio-cultural characteristics are so much alike that the description of one closely fits the other. The fact that they are bisected by the Red River Delta (included in Area I) prompted the decision to delineate them as separate areas.

Area IV includes the five parishes of Jackson, Union, Grant, Caldwell, and LaSalle. In general, this area may be referred to as a cut-over pine and hardwood area characterized by self-sufficing and part-time farming. This area is definitely set off from surrounding areas in many respects. First, it has the highest proportion of rural nonfarm inhabitants, indicating most rural residents are not bona fide farmers. Next, it has, except for Area V, the lowest farm value index of any area. It also ranks lowest in value of farm products sold. As might be expected in an area of infertile soil, there is an extremely low density of population. As is true in all cut-over areas of the state, the proportion of Negroes in the population is low. Fertility is low in this area, accounting for the high age index. Significantly, both level of living and education are above average.

By way of summary, Area IV can be described as one of small holdings scattered about in the midst of large timber tracts. Relatively little commercial agriculture is done, although cotton is the chief cash crop. Range cattle and hogs are common and fit into the pattern of subsistence farming which is prevalent throughout the area. The majority of rural residents work part-time in the lumber and pulpwood or allied industries. They live in small houses scattered throughout the area and represent a hardy, individualistic personality type.

Area V, The West Central Cut-over Area

As mentioned in the discussion of Area IV, Area V is similar to it in most every respect except location. The latter includes only three parishes, all bordering on the Texas boundary—Beauregard, Sabine, and Vernon.

Similar to Area IV, Area V is a relatively poor agricultural area. The terrain features include level to rolling cut-over pine land. There is a great deal of reforestation activity in Area V, and possibly it will someday regain prominence as a lumber center. Almost all of the timber land is in the hands of large operators.

One livestock enterprise is found to a much greater extent in Area V than anywhere else in the state. This is sheep. These animals traditionally have been maintained on open range conditions along with cattle and hogs. They are kept for wool rather than for mutton, however. The concentrations of sheep are in Beauregard Parish.

Area V is also one of self-sufficing farms, with relatively few Negroes and a low density of population. Level of living and education tend to be average or slightly below average. Possibly because of its distance from large population centers, it has the highest infant mortality of any of the areas. The value of farm products sold is relatively small, with cotton being the Number One cash crop.

The people in Area V are, if anything, more reticent to adopt new things and more individualistic than those of Area IV. They tend to be somewhat suspicious of strangers, ask few favors, and mind their own business. There is a strong tradition of violence in the area. The above characteristics can be explained in terms of the history of the area. (See the discussion of cultural islands which follows.)

Area VI, The Southwest Rice Area

Area VI is located in the southwestern part of the state. It contains the following six parishes: Cameron, Calcasieu, Allen, Jefferson Davis, Acadia, and Vermilion. This is the first of the south Louisiana French areas to be considered. The prime characteristic of this area, however, is the cultivation of rice. With the exception of four parishes, all parishes in the state producing over 5,000 acres of rice in 1950 were found in Area VI.

Two border parishes detract somewhat from the homogeneity of the area. Allen Parish to the north includes a considerable cut-over area within its boundaries and the inhabitants in this portion of the parish are more like the people living in Area V. However, the southern part of the parish is definitely French and devoted to rice culture. The latter outweighs the former in giving an over-all character to the parish. Cameron Parish to the south has only a relatively small proportion of its area suitable to agriculture. The remainder is in marshlands and is devoted to trapping and hunting. In this connection, a large acreage of the parish is set aside as game refuges. The area in agriculture is primarily devoted to rice and cattle and this is why it is included in Area VI. It might be mentioned that a good proportion of Vermilion Parish is also in marshes and has abundant fishing, hunting, and trapping activity.

The culture of rice is more responsible than anything else for the homogeneity of Area VI. Since this crop is unique in its requirement for water, it necessitates a wholly different farming approach from the so-called highland crops. Area VI has a relatively high farm value index, as might be expected, in a region of highly commercial farms. It ranks high in values of all farm products sold, average size of farm, proportion of land in farms, and level of living. The only indexes on which this area

ranks below average are population fertility, dependency ratio, and Negro infant mortality. In the latter regard, there are relatively few Negroes in this area.

By way of summation, it may be pointed out that the farms in this area require more than the usual outlay of cash to operate, and have possibly been mechanized for a longer period than have those in any other part of the state. The people are mostly of French extraction, although there are several settlements of midwesterners. The latter were induced to settle in the area by the so-called "father" of the Agricultural Extension Service, Seaman A. Knapp. The people are industrious, and more prosperous than the average. They are friendly and take their farming seriously. In this connection, this area was one of the first to go into extensive production of beef cattle. In a way, Area VI can be called the bread basket of Louisiana.

Area VII, The South Central Louisiana Mixed Farming Area

Area VII includes four parishes in south central Louisiana which have such diversified agriculture and characteristics that they do not fit with surrounding areas. The parishes in this area—Evangeline, St. Landry, Avoyelles, and Lafayette parishes—represent the most densely populated and intensified farm area of the state.

Actually the above group of parishes presented somewhat of a problem in delineation because of their heterogeneity. There is no doubt that they represent a sort of buffer zone between other areas. They are strategically located between the major rice, cotton, and cane areas and all three crops are found in quantity in the area, plus sweet potatoes and truck crops. Also, the zone of transition between north and south Louisiana touches three of the parishes.

Area VII possibly owes its homogeneity more to its numerous small farms (the smallest average size of any of the areas) and its French culture than to anything else. It also stands out because its rural population has the highest density per square mile, and its agricultural productivity is the highest of all areas. The proportion of land in farms and tenancy is also fairly high in these parishes. In most other characteristics Area VII is near the average for the state.

In general, Area VII is one of mixed farming, family farms, and high production, populated by a hard-working class of Yeoman farmers, who are French and Catholic for the most part. In some ways its people have been conservative, clinging to many of their old customs. In other ways they have been progressive and have adapted well to the changing times. The traveler through the area senses that the people of the area enjoy their life and lot to a greater extent than is usual for a rural people.

Area VIII, The Sugar Bowl Area

The majority of the sugar cane in Louisiana is grown in Area VIII. The parishes included in this area are often referred to as the Sugar Bowl of the state. They include West Baton Rouge, Iberville, St. Martin,

Iberia, St. Mary, Assumption, Ascension, St. James, St. John the Baptist, Lafourche, and Terrebonne. All of Area VIII is included in French south Louisiana.

Not only are the parishes in Area VIII characterized by the production of sugar, but all of them are fairly large producers of fish (shell and otherwise) and furs, and have substantial livestock enterprises. Truck crops are also important in most of the parishes in this area.

The sugar farms, like the rice farms, are largely commercialized, and parts of Areas VII and VIII are well represented by the term "factories in the field." In this regard, it is significant that Area VIII has the largest average size farm of all the areas. The many small vegetable farms found here are generally family-owned and operated, however, and are in direct contrast to the large sugar plantations.

The proportion of Negroes is relatively high in this area, a phenomenon related to the predominant system of agriculture. Fertility of the population is extremely high, something which is not surprising in a predominantly Catholic region. Other characteristics related to a high birth rate are a high dependency ratio and a low age index. The rural population is fairly dense in Area VIII, ranking sixth in this respect among the ten areas. Education and level of living are relatively low.

In many ways Area VIII is a different world from the rest of Louisiana. Its food dishes, for example, take advantage of a plentiful sea food supply and are both unique and appetizing. Also, its Catholic and French culture tends to make it more carefree and less puritanical than its neighbors to the north.

Area IX, The Florida Parishes Area

Area IX gets its name from the historical fact that it was included as part of Florida at one time. It is located in the southeasternmost part of the state and includes the parishes of St. Helena, East Baton Rouge, Livingston, Tangipahoa, and Washington. East Baton Rouge Parish, including the relatively large urban center of Baton Rouge, is somewhat of a misfit, but is still more closely related to this area than to others contiguous to it.

Area IX is probably more of a dairy area than anything else. Milk production has been encouraged by the ready market for this commodity in New Orleans and Baton Rouge. The area also has a considerable acreage of strawberries and vegetable crops. It also includes most of the tung orchards of the state. Some cotton and beef cattle are produced, but nothing like most of the other areas. Pine and hardwood forests are found throughout the region and represent one of the major sources of income.

The education and level of living of the rural people in Area IX are quite high, relatively speaking. The population density is also fairly high. Interestingly, infant mortality rate is lowest of any area for both whites and Negroes. This is no doubt associated with its proximity

to health facilities. The average size of farms is low, with much of the land being held in large timber tracts.

The white settlers in this part of south Louisiana are almost all Anglo-Saxon and Protestant. In this respect, they resemble the populace of Areas II, IV, and V more than the adjacent southern Louisiana areas. The people of Area IX also resemble the inhabitants of Areas IV and V in other ways. Many of them, for example, are not full-time farmers. They live in small homes scattered throughout cut-over areas much as in the western and north central parishes. They also work in forest products industries to a considerable extent. Finally, there is a tradition of violence in part of the area, although it seems to have a different origin than that found among the people of the western parishes.

Area X, The New Orleans Truck and Fruit Area

The last area to be described generally falls under the influence of the metropolis of New Orleans. In other words, its culture and agricultural production are geared to the city's needs. Included in this area are St. Tammany, St. Bernard, Plaquemines, Jefferson, and St. Charles parishes. The parish of Orleans is not listed in this classification of rural areas, as it is completely urban.

As mentioned above, the agricultural production in Area X is of the type that can be easily disposed of in the nearby city. It includes all types of vegetable crops, oranges (in Plaquemines Parish), nursery products (principally in St. Tammany), and considerable milk and beef cattle. It should also be mentioned that a large portion of the fish and fur produced in Louisiana come from this area.

The residents of Area X probably represent more ethnic diversity than any of the areas of the state. Persons of Slavonian, Dalmation, Italian, French, Spanish, German, and Indian ancestry are found in considerable numbers in this area. Unlike Areas VI, VII, and VIII, the French influence is not predominant.

Area X has the smallest proportion of land in farms of any area. Much of its land is in marshes unsuited to agriculture. It also has the smallest percentage of persons listed as rural farm of any area. No doubt because of proximity to New Orleans and ample opportunity for part-time industrial work, this area has the highest level of living of all areas. It is thus best characterized as one of diversity in social as well as economic characteristics.

CULTURAL CONTRASTS AND ISLANDS IN RURAL LOUISIANA

The great diversity of racial and ethnic elements in Louisiana's population is directly related to its rich history and the attraction of its abundant natural resources. The many races, nationalities, and other minority groups settling in the state did not always mix smoothly and thoroughly with the larger population.⁴ This fact has accounted for the

⁴For a comprehensive discussion of race and nationality in the state, see: T. Lynn Smith and Homer L. Hitt, *The People of Louisiana*, Baton Rouge: Louisiana State University Press, 1953, Chapter IV.

presence of numerous cultural islands within the state. The absence of a ready locational reference to these islands and to the two rural Louisianas (one north and one south) prompted the writer to attempt such delineations.

The methodology employed was geared to the time and resources available and is quite simple. In the course of visits in each parish of the state, county agents and others were asked to locate the zones and areas sought on maps of the parish. Where feasible, these localities were visited and local sentiment and feeling toward the cultural islands were determined as much as possible. Extensive library searches were later made to fill in the history of the several cultural islands located in the state. From his preliminary study, the writer is firmly convinced that this type of research has a great potential for a better understanding of rural society.

The Dividing Line of the "Two Louisianas"

At the time Louisiana was acquired by the United States, the southern portion of the state was fairly well settled by the French. The descendants of these original settlers constitute an important part of the present state population. In fact, it has been estimated that between 40 and 50 per cent of the state's people are of French descent.⁵ The descendants of French settlers have preserved their language and culture to a remarkable extent. Interestingly, the south Louisiana French have assimilated large groups of outside ethnic elements, including Spanish, German, Irish, and the so-called "Americans."

It is not the purpose here to do more than show the broad line of transition between French and Anglo-Saxon Louisiana. The general characteristics of the rural social areas in each region have already been described. Persons interested in the more detailed characteristics of these two areas are referred to the various bulletins and books pertinent to the subject. Suffice it to say that many cultural differentials, including language, food habits, religion, and recreational activity, besides those associated with earning a livelihood, separate the two Louisianas.

Figure 2 was prepared to show graphically where one might expect to cross from the one region of the state to the other. In this connection, it may be noted that there are a few pockets of English speaking, Protestant persons in south Louisiana, as well as a few French, Catholic communities in north Louisiana. These isolated settlements do not influence the larger populations to any great extent, however.

Major Cultural Islands of Rural Louisiana

As noted elsewhere, there are several communities of more or less assimilated racial and ethnic groups scattered throughout the state. Some of these "islands" show indications that assimilation is taking place rapidly, while others give little evidence of this process. All pre-

⁵*Ibid.*, p. 49.

sent problems in terms of group relations and are cause for special concern on the part of county agents, school superintendents, and others.

An attempt was made to locate all "cultural islands" in rural areas of the state of present-day significance. It is possible that some may have been overlooked, but the writer is fairly certain that the large groups are shown. Because of many misconceptions and erroneous ideas, a brief account of the history and characteristics of the larger groups is given. The location of the various "islands" is shown in Figure 2.

The Spanish Americans of Delacroix Island

A unique Spanish-American community is located on Delacroix Island in St. Bernard Parish. This island is situated about ten miles from the Mississippi River along Bayou Terre-aux-Bouefs. Actually, Delacroix Island is not an island in the true sense of the word, but rather a strip of high ground built up by the deposits of the river. Sig-

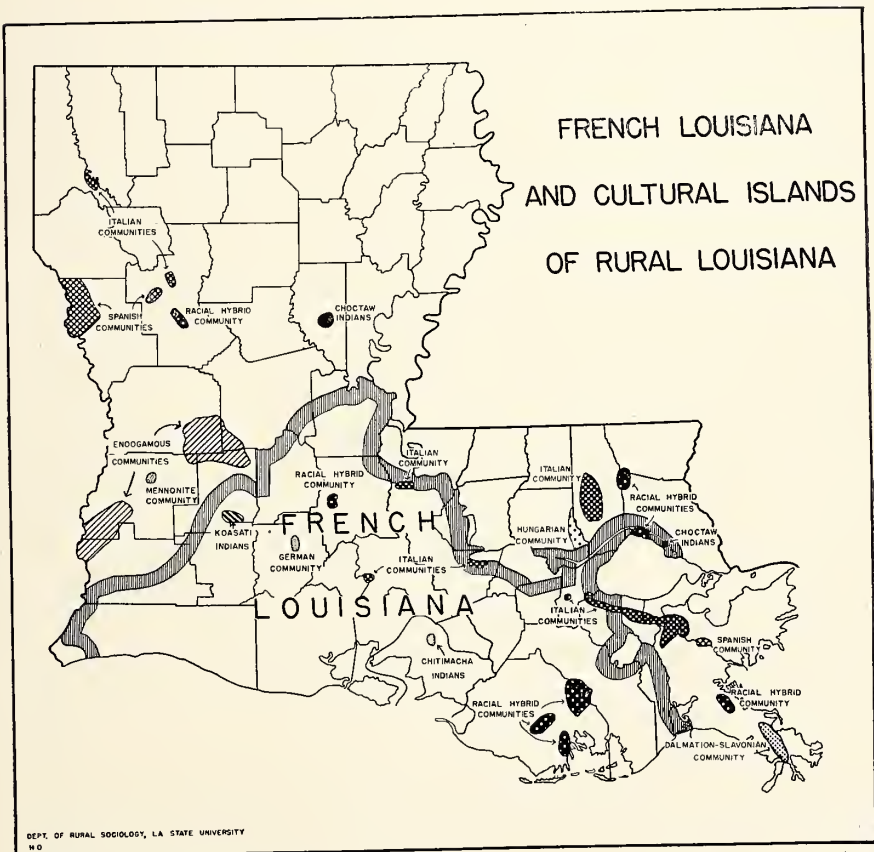


FIGURE II.—Location of French Louisiana and the major cultural islands of rural Louisiana.

nificantly, it was at this site that one of the four first Spanish settlements in Louisiana was founded in the latter part of the 18th century.⁶

Today it is estimated that there are about 1,000 inhabitants of the Spanish community on Delacroix Island. The pattern of settlement is in the form of a line village along the Bayou Terre-aux-Bouefs. The natives have typically Spanish features and are tall, dark, and unusually handsome. They have clung to their traditions, including their language, to a remarkable degree. All are bilingual and some even trilingual, speaking French as well as Spanish and English. Spanish in a surprisingly pure form is spoken in all of the homes. It has been suggested that the "Islenos," as they are known among themselves, have been able to preserve their language and other culture because of isolation. This isolation was brought about by their location away from frequently traversed roads, and because of their occupations of fishing and trapping, which did not necessitate frequent association with outsiders. In this connection, there is no indication of miscegenation among the "Islenos," and they are characterized as 100 per cent white.

To the stranger, the "Islenos" appear somewhat aloof and suspicious. However, once strangers have shown their sincerity of purpose, the people are hospitable and sociable. Dancing and drinking seem to be the chief forms of recreation among the groups. The dances are attended by people of all ages and accompanied by great merrymaking. Weddings are the major social occasions among the group and everyone joins the fun on these occasions.

As might be expected, the "Islenos" are Catholic. Traditionally they have supported the church better than the schools. The "Islenos" could see little use for formal education when one could learn the necessary skills for trapping and fishing from his father and neighbors. Of late, however, with increasing contact with outsiders more attention has been given to elementary and high school training.

The traditional occupations of the people in this community, as has been mentioned, were trapping, hunting, and fishing. Today depletion of the muskrat, plus a declining market for fur and fish, has forced many of the "Islenos" to seek employment outside the community proper. The trend away from the island has also been speeded by the lure of high wages in New Orleans and other nearby places and by increased contacts with outsiders. The latter has come about principally through the increasing popularity of Delacroix Island with sport fishermen and as a place of residence for retired persons from New Orleans. Because of the above trend, it seems safe to predict that this cultural

⁶The information on this community is from two unpublished papers: a thesis manuscript by Marcos A. Quinones entitled, "A Sociological Analysis of a Spanish-American Community," and a term paper by Jay T. Seitz entitled, "A Brief Sociological Study of the Growth and Development of Delacroix Island." Dr. Fred B. Kniffen, of the Department of Geography and Anthropology of Louisiana State University, contributed valuable information on all the cultural islands of the state.

island will lose its peculiar characteristics in a matter of a generation or so.

The Hungarian Americans in Livingston Parish⁷

The Hungarian community in Livingston Parish was begun around the turn of the century in response to advertisements by the Brakenridge Lumber Company in Hungarian language newspapers for mill hands and of cut-over land for sale at cheap prices. By 1908 the Hungarian community now known as Albany was well established. Almost all of the Hungarians coming to the Albany community were descendants from the peasant class in the country of their origin. It is thus not surprising that they came with a real "land hunger." They worked hard to buy tracts of land, and their love for the land was demonstrated when they did not follow the sawmill out of the community in 1914.

Since the Hungarian Americans in the Albany community are relatively recent arrivals, the original settlers are still alive for the most part. Along with their children and grandchildren, they make up the three generations of the community. Many old country customs linger on in the Hungarian community. These are manifest primarily within the environs of the family. The father, for example, is definitely the head of the household and maintains considerable influence even on his adult children. The mother's status is below that of the father but well entrenched as second in command. Her special domain is the home and kitchen. In the latter she prepares the traditional dishes of the old country such as "toltot kaposta," or stuffed cabbage, and "gulas," the famous Hungarian goulash. Until quite recently bread was baked in an outdoor oven, in the traditional manner, by the wives of the community. This custom is now revived only on the occasion of festivals.

The people of Albany are churchgoers with three-fourths of the people belonging to the Catholic church and one-fourth to the Presbyterian church. Much of the recreational life of the community is centered in these churches. In the early days the Hungarian Americans at Albany organized and ran their own school, where they taught the Hungarian language and religious doctrines as well as the regular subjects. This school has been replaced by a public school where all children are now sent. The median years of school attained by persons 25 years and over is over six and compares well with that of the rural-farm population of the state.

Agriculture is the mainstay of the Hungarian Americans and 90 per cent of them are farmers. Significantly, the women take pride in maintaining their household duties while doing a day's work in the field. Children also take their place in the fields at an early age. A very large proportion own their farms, which are, on the average, approximately 30 acres in size. Interestingly, these farmers have had thriving

⁷The chief source for this discussion is: John H. Allen, "A Sociological Analysis of a Hungarian-American Community," Unpublished Master's thesis, Louisiana State University, 1951.

farm cooperative associations since 1910. There are two of these associations in the community at the present time, and these organizations function as purchasing as well as marketing associations.

Within recent years considerable evidence of a speeding up of the process of assimilation has been noted. For example, an increasing number of the people in the community cannot or will not speak the Hungarian language. There is also a constant flow of younger members to the outside world with the consequent broadening of cultural contacts. Inter-marriage with the greater society, the acid test of assimilation, has lagged to a considerable extent, but now is an increasing phenomenon. All in all, it seems safe to predict that it will be some time before this cultural island becomes engulfed in the sea of culture around it, but the process seems inevitable.

The Italian-American Communities in Louisiana

The largest group of foreign white stock in Louisiana is of Italian ancestry. Although the majority of Italians are found in New Orleans, a rather large proportion of the group coming to Louisiana settled in rural areas. There is one especially large Italian-American community in Tangipahoa Parish and another along the Mississippi River in the upper portions of St. Charles, Jefferson, and Plaquemines parishes. Other smaller communities of Italians are scattered throughout the sugar and trucking regions of south Louisiana.

The Italians are probably being assimilated faster than any of the other recent immigrants to the state, although in one or two instances they have not been readily accepted by the communities in which they have settled. They have been willing for the most part to give up their native language and have not been especially barred from inter-marriage with outside groups. However, the recency of their arrival into Louisiana (around the turn of the 20th century) has not given time for complete assimilation.

The largest rural concentration of Italians is found in Tangipahoa Parish.⁸ The group settling in this locality has played an important part in the state's strawberry industry. They, as well as the other south Louisiana Italian communities, have also been important producers of the various truck crops. In fact, it is a definite characteristic of the Italians in rural Louisiana to be associated with small fruit and vegetable type farming.

Among the Italian Americans, perhaps more than in other ethnic communities, status is associated with Americanization. In other words, there is a much stronger attempt to become associated with the larger society than among most other immigrant groups in Louisiana. This means that the Italian communities will probably become completely

⁸See Luther Williams, "The People of Tangipahoa Parish: A Sociological Comparison of Two Ethnic Groups," Unpublished Master's thesis, Department of Sociology, Louisiana State University, 1951.

assimilated in a shorter than average time. Related to this phenomenon is the support of schools in the Italian communities. They have readily seen the advantage of education to assimilation. This is interesting because most immigrants came from areas in Italy which did not emphasize schooling. As might be expected, the Italian communities are all Catholic in religion. In this regard they have sometimes incurred the displeasure of their neighbors in certain Protestant areas because of their lack of concern for laws pertaining to gambling, drinking, and similar activities.

In general it may be said that the Italian-American communities in rural Louisiana are composed of truck and small fruit farmers on small farms. They continue to exhibit much of their old-world culture but are continually striving to become assimilated. Surveys of the attitudes of outsiders show that this goal is far from being completely accomplished but that much progress has been made.

The Slavonian-Dalmatian Americans of Plaquemines Parish

A community of Slavonian and Dalmatian immigrants is located in the lower end of Plaquemines Parish around the town of Buras. The writer could find very few references to this group in the literature on Louisiana and no account of its history or description of its social organization. Visits in the community and talks with persons living here have given him some insight into their occupations and customs, however.

These people are principally engaged in citrus farming and operate family-size farms along the high land next to the Mississippi River in lower Plaquemines Parish. It is significant that all the commercial citrus of the state is produced in this area. In connection with their citrus culture, several of the families have developed a thriving orange wine business. Others of the group are fishermen who gain their livelihood from the abundant sources of oysters, shrimp, and fish in this vicinity.

The people of this community live in a sort of line village, probably more out of necessity than because of cultural heritage. They are reportedly good farmers, but are individualistic in many ways. It is reported, for example, that this group has little to do with members of the Italian community in the upper part of the parish. Apparently all outsiders must prove themselves before winning the confidence of the people.

The people in the Buras community are known both as hard workers and as shrewd businessmen. They have not only established co-ops for the more efficient selling of their fruit, but they also engage in a lively roadside marketing to passersby.

Assimilation seems to be progressing somewhat slowly, as the mother tongue is still used almost exclusively among the group. The formal schooling the younger generation is receiving along with an occasional outside marriage leads one to expect an increasing trend in this direction.

The Koasati Indians of Southwest Louisiana⁹

The only Indian tribe in Louisiana which has retained its language and racial purity to a high degree is located in the southwest corner of Allen Parish. The members of this tribe, the Koasati, reside in an area roughly five miles square just north of the town of Elton in Jefferson Davis Parish. According to the 1950 Census, the entire tribe numbered 180 persons at that time.

The Koasati are not a native Louisiana tribe. They migrated to this state from Alabama, where they were known as one of the Creek tribes. They settled in the piney woods area north of Elton some 150 years ago. In 1884 they were granted homestead rights to their piney woods holdings with the provision that they could not trade, exchange, or sell the land. There they have remained until this day. They live in simple frame houses scattered some distance from one another but connected by trails which cut through the piney woods.

The Koasati are known as a handsome and friendly people. They are characterized by straight black hair, dark bright eyes, and bronze skin. Their high cheekbones and round faces bear testimony to their racial lineage. They have their own language, an explosive and guttural tongue which has never been written down. The older and younger members seldom are bilingual, but those in-between generally speak some English. Their own language is used exclusively by tribe members. The Koasati attend public schools in Elton and are generally accepted by the community. Several have excelled in their studies and in athletics.

The Koasati men seem to prefer to work by the day on nearby farms, timber industries, or other public work than to farm for themselves. A few are employed as mechanics or carpenters in nearby towns. The women, on the other hand, seldom leave home. Occasionally a Koasati woman will work as a domestic servant, but generally not for long. Most usually they supplement the family income by weaving beautiful baskets out of pine needles and raffia. In connection with the latter, within recent years they have been very successful in selling their wares at festivals and fairs.

All of the Koasati belong to the Congregational Church established by a Missionary, Reverend Paul Leeds, some 50 years ago. Reverend Leeds has been with them ever since and has been a great leader in many ways. Before his arrival the Indians worshipped their own Gods, known as *Minko-Chitto*, "the Great Chief," or *Aba Chacoli*, "He who resides above."

⁹Sources include: "Louisiana Indians," *Louisiana News Digest*, Vol. 3, No. 4 (1951); Fred B. Kniffen, *The Indians of Louisiana*, Baton Rouge: Bureau of Educational Materials, Statistics and Research, College of Education, Louisiana State University, 1945, p. 83; Sue Lyles Eakin, "Lost Red Men of Bayou Blue," *Dixie, Times-Picayune Roto Magazine*, New Orleans, January 14, 1951; and the writer's own personal acquaintance with the Koasati tribe.

The Koasati have kept their blood lines exceptionally pure. They either marry within their tribe or seek mates among tribesmen in Texas and Oklahoma. Although these people are not reticent in working and visiting outside their group, it is a safe prediction that they will not be assimilated for many years. Their reserve, their unwillingness to give up their native tongue (one understood only by themselves), and their relative geographic isolation all point to this conclusion.

The Endogamous Inhabitants of Southwest Louisiana¹⁰

In parts of Calcasieu, Beauregard, Rapides, Natchitoches, and Vernon parishes are found settlements of persons who do not mix readily with the larger population. Although local folklore abounds with explanations of the origin of these groups, most of the stories have no basis in fact. At least four different accounts of their origin were given the author.¹¹ Interestingly, very few local persons actually connect these people with the unique chapter in Louisiana history which accounts for their presence and characteristics. In the latter connection, all outsiders agree that the groups involved are endogamous in nature (that is, keep unto themselves) and have a tradition of violence. After considerable research the writer has become convinced that the above-mentioned characteristics are understandable in the light of historical fact.

After the Louisiana Purchase in 1803, Spain became very much disturbed lest the Americans push forward toward the west. In the light of this concern it is not surprising that a dispute arose between the United States and Spain regarding part of the western boundary of the "Louisiana Purchase." After many threats of war and much diplomatic negotiation, an agreement was reached to hold the territory under dispute as a neutral ground until a settlement could be reached. This neutral ground, or "strip" as it was called, began at the coast of the Gulf of Mexico between the mouths of the Calcasieu and Sabine rivers. It extended between the Sabine and Calcasieu rivers to the source of the latter, where it went in a straight line to Kisatchie Creek and from there extended in a northerly direction to the 32nd parallel of N. latitude. Thence it went in a southwesterly direction to the Sabine River. The ownership of this neutral ground went to the United States by the proclamation of the Adams-Onís Treaty on February 22, 1821.

This area, then, was a sort of "no man's land" for 15 years (1806-1821). As might be expected, having no police protection from an established government, the area became an ideal hiding place for outlaws

¹⁰The primary source of the historical information cited is: J. Villasana Haggard, "The Neutral Ground Between Louisiana and Texas, 1806-1821," *The Louisiana Historical Quarterly*, Vol. 28, No. 4 (1945), pp. 1001-1128.

¹¹The stories claiming that these persons are descendants of Malays, Portuguese, Mongolians, and Tripolitan pirates seem to have little basis in fact. One author believes a few of them are the descendants of mixed-blood migrants from the East Coast. See: Edward T. Price, "The Melungeons: A Mixed Blood Strain of the Southern Appalachians," *Geographical Review*, XLI, No. 2 (1951), 271.

and bandits. Furthermore, the fact that the two main trade routes between Spanish and American territory passed through the area encouraged the latter to take up residence on the "strip". Bandits could prey on the pack trains and travelers carrying items for trade and commerce through the territory with little fear of capture. Also, any person falling afoul of either the United States or Spanish authorities could escape by fleeing to the "strip." The latter included many fugitive slaves from the United States who sought asylum from their masters. Also, the neutral ground was the assembly point for filibustering expeditions composed of persons desirous of starting a revolution against the Spaniards. It is interesting that the latter group was partially composed of renegades of one sort or another, as well as Indians. The filibusterers were roundly defeated by the Spaniards and fled back to the neutral ground, adding to its motley inhabitants still another "lawless" group.

All in all, the inhabitants of the neutral ground or "strip" were well schooled in violence. It is thus not surprising that they have been characterized by a tradition of violence to this day. With Indians, Negroes, and whites all in a small relatively isolated geographic area, it is not surprising that miscegenation took place. This is especially true since the mores of the time and the nature of the settlers did not represent strong barriers to racial intermixture. Some of the inhabitants of this area today definitely show signs of racial mixture. This fact probably accounts for the term "Redbone" (which is in local usage in connection with the groups under discussion) and for the fact that they are separated by considerable social distance from members of the greater society. It is quite certain, however, that many of these people are not mixed bloods. In this regard, their complexions and physical characteristics (no doubt inherited from a Spanish ancestry) are mistakenly associated with miscegenation.

Why the people under study have remained isolated and not welcomed outsiders is understandable in the light of their history and is associated with the socialization received from their forebears who had a right to be suspicious of strangers. However, it has not been unusual for the men in these communities to seek employment outside their group. They have generally been employed as laborers, especially in the forest products industries. Most of the people live on small farms of a subsistence type scattered throughout the piney woods of this part of Louisiana. A few are relatively well off and have good farms. There are at least three small towns in which persons from this group reside.

Intermarriage with outside groups has apparently been practiced to some extent, but is not too common. The opportunity for schooling, service in the Armed Forces, and work in nearby towns and cities seems to be speeding the process of assimilation. It is probable, however, that the endogamous nature of the group will not be changed for several years to come.

The "Sabines" of Terrebonne and Lafourche Parishes¹²

One of the largest cultural islands in rural Louisiana is found in the marshy fringes of Terrebonne and Lafourche parishes. It is composed of a tri-racial group, representing mixed white, Indian, and Negro ancestry. In this connection, the physical characteristics of individuals suggest that the white and Indian admixture predominates. Locally, the members of this group are known as "Sabines."

According to historical documents, the Indian element present in the Sabines is derived principally from the Houmas, one of the Muskogean tribes. Reportedly members of this Indian tribe took up residence in the present general location of the Sabines sometime during the later 18th and early 19th centuries. Whites and Negroes also began settling in the same area at about the same time. Apparently there was little reluctance to intermarriage, and miscegenation began immediately. By the turn of the 20th century the Indians had completely lost their identity.

The location of the Sabines is shown in Figure 2. Interestingly enough, they have been increasing their numbers at a phenomenal rate. In this connection, there were only 1,371 Sabines reported in 1940 as compared with 2,291 in 1950. This represents an increase of 67.1 per cent in a ten-year period. The factors causally related to this large natural increase are not readily apparent. There is, of course, a very high birth rate. One would also expect a high death rate. However, mortality does not seem to be excessive. In this regard, it has been suggested that the mixture they represent has chanced to be an extremely virile one.¹³

Most of the Sabines are clustered in groups at intervals along the bayous in what might be called a line village pattern. The remainder live deep in the marshes in places accessible only by boat. Occasional whites are interspersed with the former group, but none are found among the latter.

From a racial and cultural standpoint, the Sabines are a marginal people. They are more or less rejected by the whites (with the exception of missionaries, welfare workers, and bar and dance hall operators) and they refuse to fraternize with the Negroes. Isolation is further promoted by the fact that they speak French exclusively within their groups. In this connection, the introduction of mission schools has brought some bilingualism. Language and social distance have been the two factors which have acted as deterrents to migration and assimilation.

The principal occupation of the Sabines is shellfishing and the trapping of fur-bearing animals. There is very little agriculture among this group beyond a few small garden plots.

¹²The major source for this section is: Vernon J. Parenton and Roland J. Pellegrin, "The Sabines: A Study of Racial Hybrids in a Louisiana Coastal Parish," *Social Forces*, Vol. 29, No. 2 (1950), 148-154.

¹³John R. Swanton, *Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico*, Smithsonian Institution, Bureau of Ethnology Bulletin 43, Washington: Government Printing Office, 1911, p. 292.

Recent years have brought some change to the Sabines in the way of material improvements. These have affected their way of life only to a limited extent, however. The basic patterns of their way of life remain almost unaltered. As Parenton and Pellegrin point out, "... it appears that the plight of the Sabines has been maintained primarily as a result of their racial, social, and cultural isolation."¹⁴

Minor Cultural Islands

In addition to the major cultural islands described above, there are numerous small groups over the state which are more or less distinct. It is only possible to mention these in passing.

Indian Groups. In St. Mary Parish near Franklin, Louisiana, the remnants of a once large Indian tribe are found. The Chettimanchi (or Chitimachas) reside on the only Indian reservation in the state, a small area of some 265 acres. Although about 180 persons live on the reservation, very few of them are pure-blooded as only one-quarter Indian blood is necessary to obtain reservation privileges. They have lost their language, and speak French and English instead. The Chettimanchi admit they are a dying race. They note the young are leaving the reservation and the old people are gradually passing away. This group is best known in its neighborhood for the beautiful cane baskets they make and their beliefs in totems or sacred animals which guard them in their hours of peril.

A few present-day descendants of the once great Choctaw nation remain in Louisiana. They live chiefly in St. Tammany Parish near La-Combe, and in LaSalle Parish near Jena. An interesting sidelight regarding these Indians is the fact that they own a Bible translated in their own language. The translation was done by Abbe Adrian Rouquette, one of the first Catholic missionaries in the state. The remaining Choctaws, as most other Indian survivors, are pathetic in their memories of the days when their people were members of a large and proud nation.

A few Indians reside in almost every parish of the state, but besides the above, none appear to be numerically significant.

Other Racial Hybrids. The people of mixed blood, as indicated before, are set aside by their intermediate status. They rank themselves above Negroes but seldom are accepted by the whites. Other designations for these groups besides the Sabines and Redbones already discussed are "Free Jacks," "Jerry Brindles," and "Free Mulattoes." The "Free Jacks" are supposed to be a mixture of French and Negro, the "Jerry Brindles" a mixture of Anglo-Saxon and Negro, whereas the "Free Mulattoes" are only recognized as a mixture of white and Negro. The term "Jerry Brindles" is used principally for identifying hybrid groups in the Florida parishes, the term "Free Jacks" is frequently used in St. Tammany Parish, while the designation "Free Mulattoes" or "Mulattoes" is commonly

¹⁴*Op. cit.*, p. 154.

used to refer to groups in St. Tammany, Plaquemines, Natchitoches, and St. Landry parishes.¹⁵

Other Ethnic Groups. Most of the smaller foreign language groups to settle in the state have already been assimilated. In this connection, the colony of Belgians at Many, the Spanish colony at Robeline and in Lafourche and Iberia parishes, the German settlements in St. Tammany and along the lower Mississippi, among others, are no longer recognized as distinct groups. There are, however, two or three settlements which have not been completely assimilated. Among these are the German settlement in Acadia Parish, and the Spanish community in Sabine Parish. The Mennonite community in Beauregard Parish is set aside as a religious cultural island.

COMPARISON OF THE RURAL SOCIAL AREAS OF LOUISIANA WITH OTHER DELINEATIONS

One purpose of the present study was to make a comparison of the areas delineated with the State Economic Areas of the Seventeenth Decennial Census and the type-farming areas of the state. These comparisons are presented in the two sections which follow.

Rural Social Areas Compared with State Economic Areas

The first difference noted between the present delineation of rural social areas and the state economic areas is that the former are more numerous, including ten rather than eight regions. (See Figures 1 and 3.) Careful inspection shows some similarity between the two sets of areas but, more significantly, indicates substantial differences.

The first major difference between the two delineation is that State Economic Area IV includes both rural social areas II and IV with the exception of Ouachita Parish. The latter is included in Economic Area II, which is the Mississippi Delta area. Another major difference is the inclusion of rural social areas IX and X plus East and West Feliciana parishes in one state economic area (Area V). Two minor differences besides the shifting of Ouachita Parish may be noted. First, DeSoto Parish is included in the Western Louisiana cut-over area, rather than in the Red River Delta as is done in the present study. Secondly, Pointe Coupee Parish is placed in the Central Louisiana Mixed Farming area rather than in the Mississippi Delta Area.

In conclusion, it seems justifiable to suggest that the State Economic Areas have utility up to a certain point. The Rural Social Areas of the present study are more detailed, however, and would be more useful to most researchers.

Comparison of Rural Social Areas with Type-Farming Regions

Figure 4 was prepared to show the location of the various farming enterprises of the state, and to make possible a comparison with the

¹⁵For persons interested, a thorough sociological study of such a community was done by Joseph H. Jones. This study, entitled "The People of Frilot Cove: A Study of a Racial Hybrid Community in Rural South Central Louisiana," is an unpublished Master's thesis on file in the Louisiana State University library.

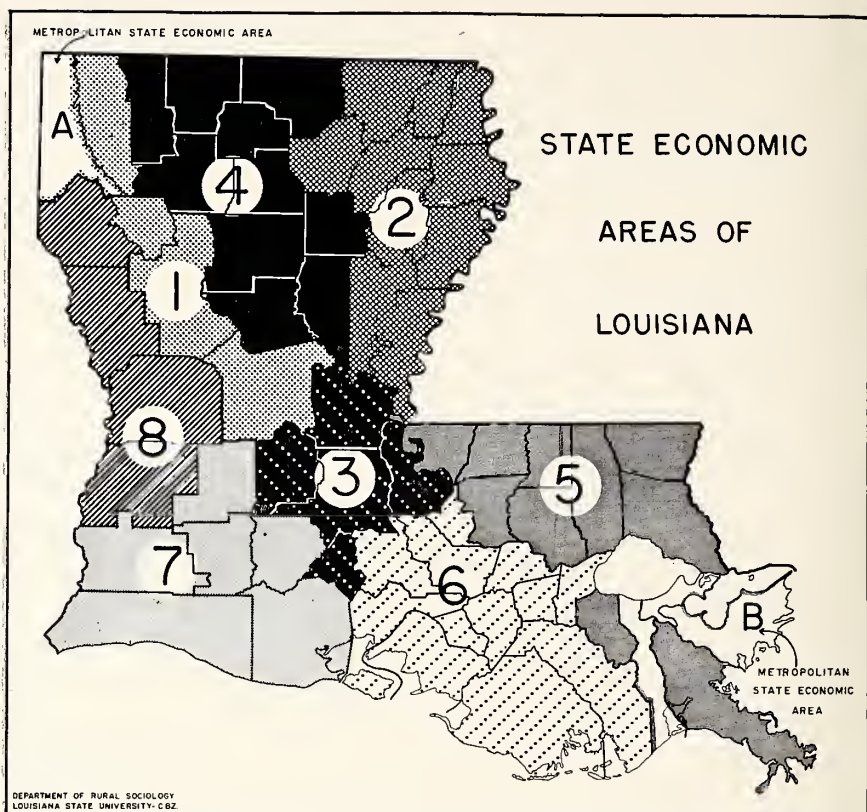


FIGURE III.—State Economic Areas of Louisiana delineated in the Seventeenth Decennial Census.

rural social areas. This sort of comparison is significant because it shows the relationship of occupational and physiographic factors to socio-cultural variables.

It is apparent at first glance that there is a close relationship between type-farming and the areas delineated. The two delta areas stand out as producers of cotton and cattle, while the north Louisiana uplands produce mostly cotton. The two cut-over areas and the Florida Parishes area show up as places which are short of any type crops. The rice and cane sections clearly demonstrate the impact of these enterprises on social life. Finally, the New Orleans area is set aside as one of great diversity in physiography and occupation.

The obvious conclusion from the comparisons made above is that type-farming has an extremely significant influence on social life in rural areas. This is demonstrated by the fact that a set of socio-cultural variables, used almost independently of farming enterprises, serves to mark off areas roughly set off by differences in agricultural enterprises.

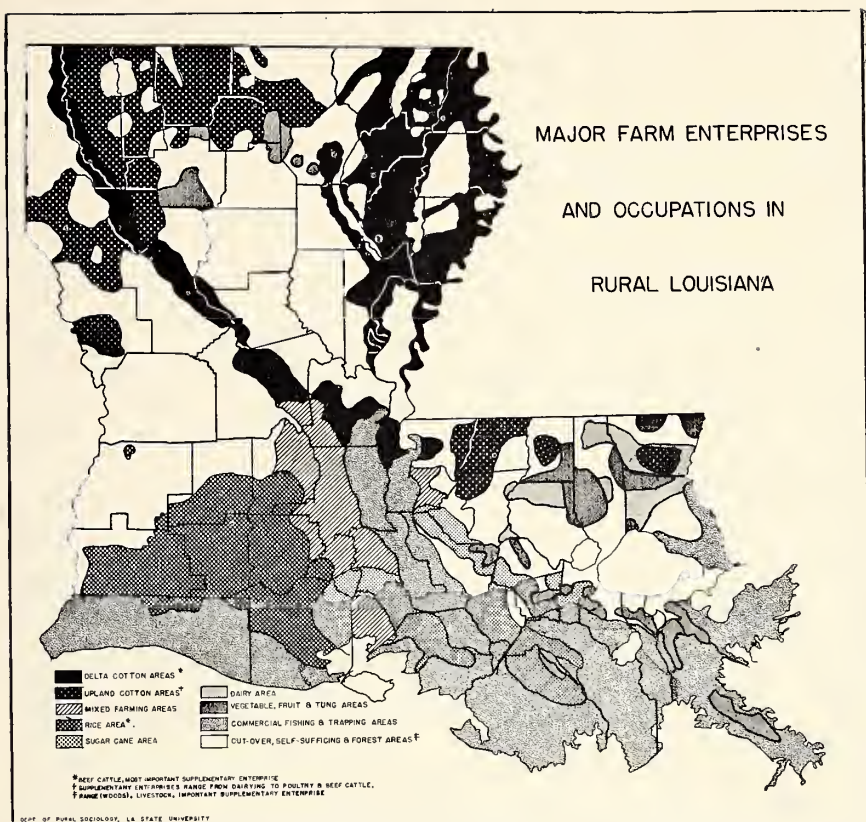


FIGURE IV.—Location of major farm enterprises and occupations in rural Louisiana, 1950.

SUMMARY

1. Through the use of empirical tests of significance, seven variables were isolated as important determinants of socio-cultural homogeneity in rural Louisiana. These variables are: school expenditures per student, proportion of land in farms, age composition of the rural population, race composition of the rural population, level of living of the rural non-farm population, level of living of the rural farm population, and the fertility ratio of the rural farm population.

2. The above mentioned variables were used to delineate ten homogeneous rural social areas in Louisiana. The areas may be briefly described as follows: Area I, The Red River Delta Area, is characterized by large plantations, devoted to the production of cotton and beef cattle; a high rate of tenancy; a relatively large number of Negroes; and a relatively low level of living. Area II, The North Louisiana Uplands Area, located in the hilly parishes of the northern part of the state, is a

region of family size, owner-operated farms. Cotton, livestock, and poultry are the most common farming enterprises in the area. Both level of living and education are relatively high in this area. Area III, The Mississippi Delta Area, is similar to Area I in character. The chief farm enterprises are cotton and beef cattle, and farms are large commercial operations. There is a high proportion of Negroes, a high rate of tenancy and a relatively low level of living in this area. Area IV, The North Central Louisiana Cut-over Area, is one of little farming. It is characterized by a rural nonfarm population living on small holdings scattered throughout large timber tracts. The farming which is done is of the self-sufficing type. Interestingly, the people of this area have a higher level of living and more education than the average for the state. Area V, The West Central Cut-over Area, is like Area IV in most of its characteristics. Farming is of the self-sufficing type, with much of the land devoted to timber production. Level of living and other characteristics are near the average for the state. Area VI, The Southwest Rice Area, is in French south Louisiana. It is an area of highly commercialized rice and cattle farms. This area is above average on almost all the socio-cultural variables. Area VII, The South Central Louisiana Mixed Farming Area, is the most densely populated farming area of the state. This area produces rice, cotton, sugar cane, and sweet potatoes in quantity, on small family owned and operated farms. It is also located in French Louisiana. Area VIII, The Sugar Bowl Area, stands out because of its large sugar cane farms. However, farmers in this area have a substantial income from livestock and truck crops. Fishing and trapping activities round out the occupations of the rural inhabitants of the area. Area VIII is in French south Louisiana and has a relatively high birth rate, relatively low level of living, relatively low educational level, and a relatively large number of Negroes. Area IX, The Florida Parishes Area, is more of a dairying region than anything else. It has, however, a substantial acreage in truck and fruit (strawberry) crops. There is also a great deal of timber activity in the area. Education and level of living are high in this area, as is generally true in regions of small family owned and operated farms. Area X, The New Orleans Truck and Fruit Area, is geared to the needs of the metropolis of New Orleans. It produces truck crops, oranges, fish, and fur in quantity. It is also characterized by a relatively high level of living and great cultural diversity.

3. Louisiana can definitely be divided into two major cultural areas. South Louisiana is French and Catholic in culture and is concerned with the growing of rice, sugar cane, and truck crops. It also has extensive fishing and trapping enterprises. North Louisiana is predominantly Anglo-Saxon and Protestant in culture and devotes itself almost exclusively to growing cotton and beef cattle.

4. Louisiana has several communities of more or less assimilated racial and ethnic groups scattered throughout the state which complicate the work of county agents and others. The major "cultural islands" are: the Spanish-Americans of Delacroix Island in St. Bernard Parish;

the Hungarian-Americans in Livingston Parish; the various Italian-American communities; the Slavonian-Dalmation community of Plaquemines Parish; the Koasati Indians of southwest Louisiana; the Endogamous inhabitants of southwest Louisiana; and the "Sabines" of Terrebonne and Lafourche parishes. Minor cultural islands also exist and contribute to the complexity of rural life in the state.

5. The State Economic Areas of the Seventeenth Decennial Census vary considerably from the rural social areas delineated. This fact indicates the necessity for researchers and planners to consider the latter in planning their research and programs.

6. The comparison of type-farming areas with rural social areas definitely shows a close relationship between the two. In this connection, the conclusion must be that occupational and physiographic factors are extremely important in conditioning culture.

APPENDIX

Statistical Methodology

As mentioned in the Introduction to this bulletin, the original 42 variables were reduced to 23 by combining two or more factors into one index. After this procedure, the variables were rank ordered by parishes from high to low or low to high, depending upon what was considered the most favorable condition. Sten scores were then assigned each variable. Table III shows what Sten scores were assigned each variable in each parish on the basis of the formula worked out by Canfield.¹⁶ The advantages of using the Sten scoring system are numerous and have been pointed out in detail elsewhere.¹⁷ Essentially this system converts all raw data to continuous single digit form for computing Pearson product-moment correlations either on a calculator or through the use of I.B.M. cards. The use of single digits is a great timesaver in statistical computations. A further advantage of the Sten scale is that it contains no negative values. In addition, Sten scoring has the effect not only of standardizing, but also of approximately normalizing each distribution. An obvious labor-saving advantage is that the sums of squares, means, standard deviations, and variances for each of the distributions of Sten scores are constant. These various advantages prompted the use of the Sten scoring technique in this research endeavor.

Analysis of Data

Once Sten scores were assigned, the variables were ready for the computation of a correlation matrix. The underlying hypothesis in the use of correlation analysis for determining rural social areas may be stated as follows: From a battery of logico-meaningfully related measures,

¹⁶*Op. cit.*

¹⁷Charles Coates and Alvin L. Bertrand, "A Simplified Statistical Methodology for Developing Multimeasure Indices as Research Tools," *Rural Sociology*, xx, No. 2 (1955).

TABLE III.—Sten Scores of Socio-Cultural Variables, by Parish

Parish	Sten Scores of Variables																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Acadia	4	2	3	9	8	6	5	7	6	4	3	3	2	2	2	7	5	6	3	4	3	4	3
Allen	6	5	5	4	3	3	4	3	2	4	4	5	4	4	3	5	5	6	4	5	4	6	3
Ascension	4	3	4	4	6	1	4	7	8	4	5	7	3	3	4	5	5	3	4	6	7	8	5
Assumption	1	2	1	6	5	3	8	5	7	5	6	3	5	4	5	6	5	3	4	5	7	6	7
Avoyelles	4	4	3	6	5	5	2	5	6	6	4	5	7	5	3	4	6	5	3	4	5	5	4
Beauregard	6	6	7	3	3	2	5	1	1	5	4	2	5	6	2	2	3	4	5	7	3	3	3
Bienville	5	7	6	3	5	4	5	3	4	6	6	5	5	8	6	0	6	6	6	5	3	1	3
Bossier	5	4	6	6	4	5	5	5	5	4	5	6	5	3	6	5	3	5	4	3	5	7	5
Caddo	5	5	5	7	5	7	4	8	7	2	2	5	3	4	5	5	9	4	6	3	0	4	5
Calcasieu	4	3	4	6	6	3	7	7	4	1	2	3	6	5	3	6	7	7	7	8	3	5	2
Caldwell	5	5	9	3	3	4	3	2	3	5	6	6	6	7	4	3	6	5	7	5	5	4	5
Cameron	8	8	5	3	2	4	8	0	0	4	7	2	1	8	1	4	4	8	5	6	4	4	2
Catahoula	7	6	7	4	3	6	4	2	2	7	5	5	9	5	5	2	4	4	4	3	5	3	5
Clabourne	4	7	6	5	6	6	5	4	4	6	3	8	5	5	6	3	7	4	5	3	4	4	5
Concordia	3	6	3	4	4	7	6	2	2	6	4	3	4	5	7	4	4	4	3	1	5	3	6
De Soto	5	8	7	5	6	5	5	4	4	6	4	1	5	5	7	3	5	2	4	3	5	4	5
E. Baton Rouge	3	1	2	4	6	3	4	9	7	1	1	5	5	5	5	6	8	5	7	8	2	5	2
East Carroll	0	4	3	4	7	7	4	4	5	7	2	5	6	1	8	4	2	0	0	0	8	8	8
E. Feliciana	1	7	5	4	9	5	6	5	4	5	3	2	7	4	8	3	5	1	3	3	1	7	6
Evangeline	4	4	4	7	5	6	2	5	6	6	5	4	1	4	3	5	3	6	5	3	4	3	5
Franklin	1	5	6	8	7	7	3	5	6	8	1	3	8	5	4	4	4	3	3	4	6	2	6
Grant	6	8	2	3	4	3	3	3	4	4	7	6	8	8	3	3	4	1	5	5	4	3	4
Iberia	5	3	2	6	4	5	6	6	5	3	4	3	3	2	5	7	7	5	5	4	3	4	4
Iberville	2	3	2	5	3	5	6	5	5	2	8	2	4	7	6	6	5	5	2	6	5	6	4
Jackson	5	7	8	1	2	3	4	4	4	3	6	5	4	5	4	2	4	5	6	5	2	2	4
Jefferson	3	0	3	2	1	4	5	8	5	0	1	7	8	6	1	9	2	9	7	8	3	5	1
Jefferson Davis	3	4	4	7	8	4	7	5	3	4	3	4	3	4	3	8	7	5	5	7	4	5	4
Lafayette	3	2	0	6	7	6	1	8	9	4	2	3	2	3	4	7	8	7	8	4	2	4	4
Lafourche	3	3	4	5	4	4	7	4	4	3	6	4	2	4	2	6	6	6	6	6	5	5	4
La Salle	8	5	8	1	1	2	2	2	3	3	8	6	6	9	1	3	6	8	9	6	2	1	0

(Continued)

TABLE III (CONT'D)

Parish	Sten Scores of Variables																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Lincoln	9	5	7	3	6	5	5	6	5	4	3	6	6	5	6	3	6	7	5	5	1	0	4
Livingston	3	5	4	3	3	1	0	4	5	7	6	7	4	3	2	5	2	5	6	7	6	6	5
Madison	2	4	4	5	6	8	6	3	2	6	0	6	3	3	6	4	3	3	2	2	6	7	7
Morehouse	2	4	5	6	5	7	3	5	4	5	2	4	4	2	6	3	4	3	4	2	5	5	7
Natchitoches	5	6	6	6	4	6	4	4	4	5	4	4	4	3	5	3	5	1	1	2	9	6	6
Orleans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plaquemines	4	7	5	2	1	2	5	1	2	3	9	2	7	6	.	7	2	7	5	7	5	6	1
Pointe Coupee	2	5	2	5	6	6	5	5	5	7	5	8	3	4	5	7	5	2	3	5	7	7	6
Ouachita	6	4	4	5	4	5	4	7	6	2	3	4	3	4	4	6	8	6	7	5	1	3	4
Rapides	5	2	2	7	4	4	3	4	6	5	4	4	5	7	4	5	7	6	6	5	2	2	4
Red River	6	5	6	5	7	6	5	4	5	8	4	0	0	6	5	3	3	3	4	2	5	2	5
Richland	2	4	5	7	7	8	3	5	6	7	3	3	2	4	5	4	6	4	6	3	6	3	6
Sabine	6	6	6	2	3	2	4	2	3	5	7	4	5	6	3	1	3	4	3	4	4	5	2
St. Bernard	5	4	3	0	0	3	3	3	2	1	8	4	7	6	2	8	0	8	7	9	4	4	1
St. Charles	8	5	4	1	4	4	7	5	5	2	7	7	8	6	5	7	4	6	5	7	5	5	5
St. Helena	6	8	6	3	4	4	3	3	4	9	3	9	7	2	6	2	1	1	1	4	7	6	6
St. James	4	5	3	5	5	3	8	6	8	5	7	2	4	3	6	5	3	1	4	4	8	7	9
St. John the Baptist	2	3	2	3	4	3	3	6	7	2	6	1	4	2	7	6	3	2	4	4	5	7	7
St. Landry	4	2	1	8	5	7	1	7	8	6	3	4	2	1	5	5	4	3	3	1	6	5	6
St. Martin	5	5	1	5	3	6	2	4	5	5	5	5	3	1	4	5	3	2	2	3	5	5	7
St. Mary	3	1	3	6	5	5	9	6	5	3	4	5	3	3	7	6	5	6	8	7	4	4	3
St. Tammany	7	2	5	4	2	1	4	4	3	3	5	7	5	7	4	5	7	5	3	6	4	5	3
Tangipahoa	7	3	5	7	5	9	6	3	3	7	5	6	6	5	8	4	6	3	5	2	7	1	8
Tensas	4	6	5	5	7	9	6	3	3	3	5	6	4	0	4	4	2	2	4	4	7	9	7
Terrebonne	4	1	4	4	2	2	6	4	3	2	6	4	4	7	5	2	4	7	5	5	4	3	3
Union	6	7	7	4	4	4	4	5	3	6	6	6	6	7	5	2	4	7	6	6	2	2	2
Vermilion	7	5	6	8	5	5	6	4	3	4	4	5	2	6	6	6	5	7	6	6	2	2	2
Vernon	6	4	5	2	2	0	2	1	1	5	5	1	5	7	0	1	5	4	6	4	3	2	3
Washington	7	6	5	5	5	4	4	6	5	4	5	2	3	2	4	4	5	4	6	6	4	6	5
Webster	5	5	5	4	5	5	5	6	6	3	5	4	3	4	5	4	6	5	8	6	3	4	4
West Baton Rouge	4	4	4	4	4	5	6	6	6	4	5	8	1	5	7	8	2	4	4	5	6	8	4
West Carroll	5	3	4	5	8	5	3	3	7	8	4	4	5	4	9	1	3	3	5	1	6	3	5
West Feliciana	3	9	5	3	6	8	7	5	4	5	7	6	4	4	9	4	1	5	1	4	8	5	8
Winn	7	6	7	2	2	2	2	2	1	5	4	7	6	6	3	2	4	4	2	5	3	6	3

a small number of significantly inter-correlated measures will be found which, when properly weighted, can be combined to form an index equation for accurately measuring rank order. In the present problem the idea was to discover rural social areas which were homogeneous in socio-cultural characteristics.

The first step in the procedure was to compute a matrix of sums of cross products. (See Table IV.) After this was accomplished, a correlation matrix using the Pearson product-moment formula was computed. (See Table V.)

The next step was to determine what correlations would be insignificant with 62 degrees of freedom¹⁸ for a five per cent level of confidence. Fourteen variables were eliminated as having too many insignificant correlations at this level. Those eliminated were numbers 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, and 22. (See Table I for a description of these variables.)

The remaining matrix included several negative measures and necessitated reflection in order to make all sums positive. After this was done a further inspection of the matrix revealed two variables with several insignificant correlations. These were eliminated and a composite-reflected matrix of the seven remaining variables constructed. (See Table VI.) Note that in Table VI a minus sign appears over and opposite the measures which are negatives or suppressors. Note also that in the remaining matrix there are no duplicating measures; that is, measures which have a high inter-correlation with one another.

Since the final reflected matrix included variables which, with one exception, are all significantly correlated and not duplicatory in functions, it has what may be called "statistical homogeneity." Any further attempt to reduce the number of measures in this particular problem would obviously lessen its discriminatory power. In other problems the number of measures might be reduced even further should statistical logic justify or if a one per cent level of confidence is demanded.

Weighting Procedure

There are several methods of obtaining weights for multi-measure index equations, depending upon the degree of accuracy desired. The procedure utilized in this study is one hit upon by the writer and a colleague and includes the use of what may be termed an approximate criterion. It involves the following steps.

First, the seven variables in the final matrix were rank ordered by parishes according to the algebraic sum of their Sten scores on the variables. (See Table VII.) Sten scores were then assigned on the basis of this order which was termed an "approximate criterion" of homogeneity. Secondly, the Sten score distribution of each measure was correlated with the Sten score distribution of the "approximate criterion." This

¹⁸The parish of Orleans was omitted from computations because of its urban character.

TABLE IV.—Matrix of Sums of Cross Products of Sten Scores of Socio-Cultural Variables

[illegible]

TABLE V.—Correlation Matrix of Original Socio-Cultural Variables

Variables																							
Variables 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1	..	.28	.48	-.31	-.42	-.35	-.17	-.29	-.33	-.12	.27	.18	.15	.43	-.40	-.25	.09	.44	.28	.29	-.31	-.43	-.49
2	.28	..	.65	-.31	-.22	.11	.50	-.62	-.47	.43	.27	.58	.15	.39	.24	-.66	-.29	-.08	-.17	-.18	.37	-.09	.37
3	.48	.65	..	-.37	-.19	-.13	-.07	-.55	-.54	-.21	.16	.18	.27	.47	-.11	-.64	-.12	.08	.13	.29	-.19	-.36	-.20
4	-.31	-.34	-.37	..	.61	.50	-.53	.50	.47	.22	-.47	-.21	-.47	-.42	.11	.20	.42	-.21	-.14	-.36	.46	.32	.30
5	-.42	-.22	-.19	.61	..	.55	.14	.44	.47	.41	-.55	-.14	-.24	-.37	.44	-.39	.25	-.40	-.20	-.40	.11	.67	.45
6	-.35	.11	-.13	.50	.55	..	.09	.18	.20	.37	-.42	.12	-.27	-.30	.54	-.43	-.48	-.24	-.26	-.07	.19	-.15	.50
7	-.17	.50	-.07	-.53	.14	.09	..	-.10	-.15	-.29	.13	-.20	-.12	-.22	.36	.22	-.14	-.10	-.09	.37	.10	.21	.20
8	-.29	-.62	-.55	.50	.44	.18	-.10	..	.08	-.36	-.47	.41	-.17	-.41	.14	.53	.45	-.22	.22	.09	-.22	.17	.10
9	-.33	-.47	-.54	.47	.47	.20	-.15	.08	..	-.31	-.26	-.53	-.24	-.41	.26	.34	.28	-.20	.08	-.11	.54	.16	.29
10	-.12	.43	.21	.22	.41	.37	-.29	-.36	-.31	..	-.15	.67	-.09	-.12	.23	-.57	-.30	-.49	-.46	-.57	.45	-.13	.46
11	.27	.27	.16	-.47	-.55	-.42	.13	-.47	-.26	-.15	..	-.60	.08	.40	-.10	-.60	.32	.22	.08	.23	.16	-.14	-.17
12	.18	.58	.18	-.21	-.14	.12	-.20	.41	-.53	.67	-.60	..	.26	.16	.10	-.35	-.15	.11	.33	.10	.10	.14	-.11
13	.15	.15	.27	-.47	-.24	-.27	-.12	-.17	-.24	-.09	.08	.26	..	.30	.07	-.16	-.16	.08	.33	.28	-.09	-.35	-.17
14	.43	.30	.47	-.42	-.37	-.30	-.22	-.41	-.41	-.12	.40	.16	.50	..	-.32	-.27	.33	.54	.38	.43	-.41	-.54	-.60
15	-.40	.24	-.11	.11	.44	.54	.36	.14	.26	.23	-.10	.10	.67	-.32	..	-.15	-.11	-.57	-.40	-.56	.34	.26	.66
16	-.25	-.66	-.64	.20	-.39	-.43	.22	.53	.34	-.57	-.60	-.35	-.16	-.27	-.15	..	.10	.28	.27	.39	-.48	.35	-.13
17	.09	-.29	-.12	.42	.25	-.48	-.14	.45	.28	-.30	-.32	-.15	-.16	.33	-.11	.10	..	.15	.38	.14	-.53	-.18	-.19
18	.44	-.08	.08	-.21	-.40	-.24	-.10	-.22	-.20	-.49	.22	.11	.08	.54	-.57	.28	.15	..	.64	.61	-.58	-.44	-.08
19	.28	-.17	.13	-.14	-.20	-.26	-.09	.22	.08	-.46	.08	.33	.33	.38	-.40	.27	.38	.64	..	.61	-.57	-.40	-.54
20	.29	-.18	.29	-.34	-.40	-.37	.37	.09	-.11	-.57	.23	.10	.28	.43	-.56	.39	.14	.61	.61	..	-.40	-.22	-.07
21	-.31	.37	-.19	.46	.11	.19	.10	-.22	.54	.45	.16	.10	-.09	-.41	.34	-.48	-.53	-.58	-.57	-.40	..	.46	.61
22	-.43	-.09	-.36	.32	.67	-.15	.21	.17	.16	-.13	-.14	.14	-.35	-.54	.26	.35	-.18	-.44	-.40	-.22	.46	..	.32
23	-.49	.37	-.20	.30	.45	.50	.20	.10	.29	.46	-.17	-.11	-.17	-.60	.66	-.13	-.19	-.08	-.54	-.07	.61	.32	..

TABLE VI.—Final Reflected Matrix

Variables	Variables						
	1 (-)	5	14 (-)	15	19 (-)	20 (-)	23
1 School expenditures per parish per student (-)	..	.42	.43	.40	.28	.29	.49
5 Proportion of land in farms	.42	..	.37	.44	.20	.40	.45
14 Age index	(-)	.43	.37	..	.32	.38	.43
15 Race index		.40	.44	.32	..	.40	.56
19 Rural nonfarm level of living	(-)	.28	.20	.38	.40	..	.61
20 Rural farm level of living	(-)	.29	.40	.43	.56	.61	..
23 Rural farm fertility ratio		.49	.45	.60	.66	.54	.07

necessitated the computation of the cross products for substitution in the modified equation for R. The result was the following final index equation:

$$\text{Socio-cultural score} = -.642(1) + .644(5) - .726(14) \\ + .741(15) - .603(19) - .748(20) + .885(23). \quad (\text{where all measures are in standard Sten scores.})$$

The accuracy of the weights was tested as follows. It is known that the standard deviation of any of the Sten distributions, when squared, equals its variance. The variance in the Sten score distribution of the approximate criteria, in our illustration, equals 3.742. It is also known that the squared correlation coefficient of each measure (its squared weight) represents its contribution to the variance and the criterion. In this example, the squared and sum weights equal 3.649. When the latter figure is divided by the former and the result multiplied by 100, it is found that 97.5 per cent of the criterion variance is accounted for, which obviously is extremely accurate.

The final step was the computation of the socio-cultural score for each parish from the equation as shown in Table VIII. The parishes were then rank ordered and divided into homogeneous areas according to the procedure outlined in the introduction.

TABLE VII.—Rank Order of Parishes on Summation of Sten Scores of Socio-Cultural Variables in the Final Reflected Matrix

Approximate Rank Order		Variables							Algebraic Sums	Sten Scores
		1	5	14	15	19	20	23		
1	East Carroll	-0	7	-1	8	-0	-0	8	22	9
2	West Feliciana	-3	6	-4	9	-1	-1	8	14	8
3	East Feliciana	-1	9	-4	8	-3	-3	6	12	8
4	Madison	-2	6	-3	6	-2	-2	7	10	8
5	Morehouse	-2	5	-2	6	-4	-2	7	8	7
6	St. Mary	-3	5	-3	7	-2	-3	7	8	7
7	Tensas	-4	7	-5	8	-5	-2	8	7	7
8	St. Landry	-4	5	-1	5	-3	-1	6	7	7
9	St. John the Baptist	-2	4	-2	7	-4	-4	7	6	7
10	St. James	-4	5	-3	6	-4	-4	9	5	7
11	Pointe Coupee	-2	6	-4	7	-3	-5	6	5	6
12	Concordia	-3	4	-5	7	-3	-1	6	5	6
13	Natchitoches	-5	4	-3	5	-1	-2	6	4	6
14	Franklin	-1	7	-5	4	-3	-4	6	4	6
15	St. Martin	-5	3	-1	4	-2	-2	6	3	6
16	St. Helena	-6	4	-2	6	-1	-4	6	3	6
17	Richland	-2	7	-4	5	-6	-3	6	3	6
18	Assumption	-1	5	-4	5	-4	-5	7	3	6
19	Terrebonne	-4	2	-0	4	-4	-4	7	1	6
20	De Soto	-5	6	-5	7	-4	-3	5	1	5
21	Claiborne	-4	6	-5	6	-5	-3	5	0	5
22	Bossier	-5	4	-3	6	-4	-3	5	0	5
23	Acadia	-4	8	-2	2	-3	-4	3	0	5
24	Red River	-6	7	-6	5	-4	-2	5	1	5
25	Ascension	-4	6	-3	4	-4	-6	5	2	5
26	West Carroll	-5	8	-4	3	-5	-4	5	2	5
27	Caddo	-5	5	-4	5	-6	-3	5	3	5
28	Evangeline	-4	5	-4	3	-5	-3	5	3	5
29	Iberia	-5	4	-2	5	-5	-4	4	3	5
30	Jefferson Davis	-3	8	-3	3	-5	-7	4	3	5
31	Lafayette	-3	7	-3	4	-8	-4	4	3	5
32	West Baton Rouge	-4	4	-5	7	-4	-5	4	3	5
33	Iberville	-2	3	-7	6	-2	-6	4	4	4
34	Avoyelles	-4	5	-5	3	-3	-4	4	4	4
35	Catahoula	-7	3	-5	5	-4	-3	5	6	4
36	Washington	-7	5	-2	4	-6	-6	5	7	4
37	Lincoln	-9	6	-5	6	-5	-5	4	8	4
38	Lafourche	-3	4	-4	2	-6	-6	4	9	4
39	Livingston	-3	3	-3	2	-6	-7	5	9	4
40	Tangipahoa	-7	5	-5	4	-3	-6	3	9	4
41	Allen	-6	3	-4	3	-4	-5	3	10	4
42	East Baton Rouge	-3	6	-5	5	-7	-8	2	10	4
43	Bienville	-5	5	-8	6	-6	-5	3	10	4
44	Ouachita	-6	4	-4	4	-7	-5	4	10	4

(Continued)

TABLE VII (CONT'D)

Approximate Rank Order		Variables							Algebraic Sums	Sten Scores
		1	5	14	15	19	20	23		
45	Jackson	-5	2	-5	4	-6	-5	4	11	3
46	Rapides	-5	4	-7	4	-6	-5	4	11	3
47	Sabine	-6	3	-6	3	-3	-4	2	11	3
48	Union	-6	4	-7	5	-5	-5	3	11	3
49	Webster	-5	5	-4	5	-8	-6	2	11	3
50	Caldwell	-5	3	-7	4	-7	-5	5	12	3
51	St. Charles	-8	4	-6	5	-5	-7	5	12	3
52	Winn	-7	2	-6	3	-2	-5	3	12	3
53	Calcasieu	-4	6	-5	3	-7	-8	2	13	3
54	Vernon	-6	2	-7	0	-2	-4	3	14	2
55	Grant	-6	3	-8	3	-5	-5	4	14	2
56	Plaquemines	-4	1	-6	5	-5	-7	1	15	2
57	Beauregard	-6	3	-6	2	-5	-7	3	16	2
58	Vermilion	-7	5	-6	2	-6	-6	2	16	2
59	St. Tammany	-7	2	-7	4	-8	-7	3	20	2
60	Jefferson	-3	1	-6	1	-7	-8	1	21	1
61	Cameron	-8	2	-8	1	-5	-6	2	22	1
62	St. Bernad	-5	0	-6	2	-7	-9	1	24	1
63	La Salle	-8	1	-9	1	-9	-6	0	30	0
Cross Products		-1129	1432	-1109	1455	-1138	-1104	1489		
Correlation coefficients		-.642	.644	-.726	.741	-.603	-.748	.885		

TABLE VIII.—Final Rank Order of Parishes on Socio-Cultural Scores

Rank	Parish	Socio-Cultural Score	Rank (Cont'd)	Parish (Cont'd)	Socio-Cultural Score (Cont'd)
1	East Carroll	16.790	32	Jefferson Davis	-1.440
2	West Feliciana	11.432	33	Avoyelles	-2.016
3	East Feliciana	9.435	34	Iberville	-2.142
4	Madison	8.341	35	Catahoula	-2.718
5	Morehouse	7.217	36	Washington	-3.443
6	St. Mary	7.048	37	Lincoln	-4.314
7	Tensas	6.807	38	Livingston	-5.119
8	St. Landry	6.384	39	Lafourche	-5.338
9	St. John the Baptist	5.818	40	Tangipahoa	-5.582
10	St. James	5.481	41	Ouachita	-5.637
11	Concordia	4.960	42	Bienville	-6.055
12	Pointe Coupee	4.624	43	Allen	-6.098
13	Natchitoches	4.104	44	Jackson	-6.406
14	Franklin	3.709	45	East Baton Rouge	-6.422
15	St. Martin	3.568	46	Rapides	-6.570
16	Richland	3.473	47	Webster	-6.731
17	St. Helena	3.433	48	Union	-6.753
18	Assumption	3.422	49	Caldwell	-6.932
19	Terrebonne	2.475	50	St. Charles	-7.037
20	De Soto	1.980	51	Sabine	-7.084
21	Bossier	1.403	52	Winn	-7.630
22	Claiborne	1.278	53	Calcasieu	-8.546
23	Red River	.522	54	Grant	-8.720
24	Acadia	.468	55	Vernon	-9.189
25	West Carroll	.321	56	Plaquemines	-9.941
26	Ascension	— .393	57	Beauregard	-10.390
27	Caddo	— .626	58	Vermilion	-10.484
28	Iberia	— .848	59	St. Tammany	-12.729
29	Evangeline	— .863	60	Jefferson	-14.217
30	Lafayette	— .908	61	Cameron	-14.648
31	West Baton Rouge	-1.047	62	St. Bernard	-16.152
			63	La Salle	-20.200

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The Production and Composition of Milk of Cows Cooled by Shade or Sprinkling During the Summer Months

L. L. RUSOFF, G. D. MILLER, AND J. B. FRYE, JR.*

INTRODUCTION

A definite decrease in milk production during the summer months is experienced by dairy farmers in Louisiana. The high environmental temperatures and humidity along with a lower plane of nutrition, particularly due to poor pastures and a limited roughage program during this season, are probably the main factors involved. It has been observed that cows spend most of the daytime during the hot summer months in the shade in inactivity and their body temperatures and respiration rates increase progressively. It has been suggested that the high environmental temperatures in Louisiana might also affect the physical and chemical composition of cows' milk. In order to dissipate excess heat and provide comfort for animals, sprinkling with water has been used successfully by some investigators. Therefore, it was decided to determine what effect cooling of lactating cows by shade or by sprinkling with water had on milk production and on the composition of milk during the summer months.

Experiments were conducted during the summer months of 1948, 1949 and 1950 to test this type of treatment on the production and composition of milk. Analyses were made for fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, lactose, ash, calcium, phosphorus, specific gravity, titratable acidity, and pH of the milks for three years.

LITERATURE REVIEW

It is recognized that several factors, i.e., breed, stage of lactation, plane of nutrition, season of year, and high temperature, may affect the production and composition of milk.

There are several studies on the effect of high environmental temperatures on milk production and composition. At temperatures above 80°F. it was found that milk production always decreased (2, 3, 8, 13, 18, 20, 21, 22, and 29) and that the composition of milk was also affected (2, 5, 6, 7, 10, 16, 17, 18, 20, 21, 23).

Rhoad (22) in 1935 reported that European cattle in Brazil produced only 56 per cent of their apparent capacity due to effects of hot weather. Bartlett (2) in England reported a reduction in milk yield of 0.16 pound per day, percentage fat 0.04 per cent, and solids-not-fat

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0.153 per cent at environmental temperatures of 80°F. It was pointed out that these reductions were not significant and that the high temperature was not the only factor responsible for the low quality of summer milk.

Regan and Richardson (21) in 1938, using 3 pairs of animals of the Holstein, Jersey, and Guernsey breeds in a psychrometric room at constant humidity and air movement, increased the environmental temperature from 50 to 95° F. for 5-10 days. Above 80° F. there was a decrease in milk yield, solids-not-fat, and casein. The daily milk yield declined from 25 pounds at 80° to 17 pounds at 95°, solids-not-fat from 7.88 to 7.58 per cent, and casein from 2.07 to 1.81 per cent. The values for percentage butterfat (from 4.0 up to 4.3) and pH tended to increase.

Woodward and Jensen (29) in 1942 found a marked decrease in milk production during the summer season in a study of 15,442 lactation records of cows in dairy herd improvement associations in 12 northern and western states and 101 lactation records of cows on advanced registry in the experimental breeding herd of the Bureau of Dairy Industry at Beltsville, Md. The Beltsville cows produced the least milk in July, the range of deviation from the mean being 10.4 per cent. These workers attributed this deviation to the weather.

Overman (16, 17) during 1945 conducted a study on the monthly variations in the composition of milk produced under Illinois conditions. The percentage values for all components studied in Holstein milk except lactose tended to be lowest during the warmer months. His percentages for summer and winter milks were: fat 3.3 and 3.6, protein 3.2 and 3.4, lactose 4.9 and 4.8, ash 0.65 and 0.68, total solids 12.2 and 12.5, and solids-not-fat 8.8 and 8.9, respectively.

Kastli (11) in 1945 in Switzerland reported the fat content of milk showed a gradual rise from May (3.61 per cent) to October (3.94 per cent) and a fall from then until March (3.55 per cent). The curve for solids-not-fat showed a maximum in December (9.33 per cent) and a minimum in March (8.97 per cent) and July (9.01 per cent).

Labarthe (12) in 1946 in Argentina reported highest percentages of butterfat to occur in their fall (April-June) and the lowest in their spring (October-December).

Espe (8) in 1946 reported a 23 per cent drop in milk production of the Iowa station herd during 1941 when the maximum temperature rose from 84° to 99° F. from July 20 to July 24. Another 11 per cent drop in production within 7 days occurred in August when the maximum temperature increased from 80° F. to 93° F. There were no changes in feeding or management during this time. Espe, in summarizing the findings of other investigators (4, 9, 19, 27, 28), reported that the percentage of butterfat is lowest in the summer and highest in the winter. He stated that this decrease in butterfat percentage in the summer amounted to 15-20 per cent.

Davis *et al.* (6) in 1947 investigated seasonal variations in the constituents of milk produced under Arizona conditions. The investigators analyzed one day's milking each month during lactations over a 30-month period from 11 Jersey, 11 Holstein, and 11 Guernsey cows. The mean maximum temperatures for the spring, summer, fall and winter seasons were 82.6°, 99.3°, 84.8°, and 66.9° F., respectively. The butterfat, total solids, and serum solids content of the milks were higher in winter and lower in summer. The butterfat content of milk was calculated to decrease 0.1 per cent each 10° F. rise in mean maximum temperatures. They concluded that the environmental temperature appeared to exert a greater influence on milk and butterfat production than did the advancing stage of lactation. In another paper these investigators (7) reported total solids, serum solids, fat, lactose, and protein values to be higher in winter and lower in summer, while the chloride content of the milk was higher in summer than in winter. The data were obtained monthly over a two-year period from four groups of animals, each containing 30 cows or more, representing Jersey, Guernsey, Holstein, and mixed breeds.

In South Africa, Bonsma (3) in 1947 reported that milk production declined sharply when the atmospheric temperature exceeded 85° F. He stated that when the atmospheric temperature reached 100° F., cows produced only 53 per cent of the amount of milk they produced at 70° F.

Sinha and Minett (24) in 1947 in India reported that daily wetting of the body surface of milking water buffaloes during the hot months prevented a decrease in milk yield. The animals were splashed for 5 minutes by throwing water over their bodies with buckets approximately 2 hours before milking. Four periods of 10 days each were used when the maximum daily temperatures ranged from 97° to 109° F., the relative humidity being approximately 24 per cent and the temperature of the water being 80-86° F.

Van Rensburg (26) in 1947 in South Africa, reported that solids-not-fat, fat, and lactose were lowest during the winter months. He attributed this to malnutrition during this season of the year. High temperatures did not produce a decline in milk solids, the best quality milk being obtained during some of the hottest months. Bakalor (1) in 1948, also in South Africa, analyzed the records of 6,369 official samples of milk of all breeds from January 1934 to December 1947. The solids-not-fat were lowest in the dry months and the monthly fat content was higher in winter than in summer.

Riek and Lee (23) in 1948 in Australia studied the reactions of four grade Jersey cows in a psychrometric room at temperatures of 85° to 110° F. for 7 hours, twice a week. The absolute humidity was 6.16 grams of water per cubic foot. These workers observed no effect on milk or butterfat production at these high temperatures. At high humidities and tem-

peratures the specific gravity of the milk increased from 1.0318 to 1.0346 and the percentage of solids-not-fat increased by 0.69 per cent.

Ragsdale *et al.* (20) studied the effect of increasing temperatures from 50 to 105° F. on Holstein and Jersey cows under psychrometric conditions. They found that an increase in temperature from 80 to 95° F. decreased milk production while the fat percentage increased with temperatures above 85° F. They pointed out that this rise in fat percentage is related in part to a decline in milk secretion.

Cobble and Ragsdale (5) in 1949 reported an increase in total solids and chloride, as well as fat percentage, in milk from Holstein and Jersey cows with an increase in temperatures from 80° to 90° F. Solids-not-fat, lactose, and nitrogen, particularly in Holstein milk, tended to be lower at the same temperatures. When cows were subjected to a rapid increase in temperature up to 100° F. during a 14-day period, high increases in total solids, solids-not-fat, fat percentage, chlorides, and nitrogen were obtained, while lactose values showed a decrease. Individual and breed differences in ability to withstand high environmental temperatures were observed.

In another study Ragsdale *et al.* (18) in 1950 compared the response of Holstein, Jersey, and Brahman cows to temperatures of 50° up to 105° F. Milk production started to decrease at about 75° F. in the European cattle and at about 95° F. in the Indian cattle. They found that the percentage decline in milk production was greatest in the Holstein cow, less in the Jerseys, and least in the Brahmans. On the other hand the percentage of butterfat increased with rising temperatures above 70° F.

Horner and Herzer (10) of Mississippi in 1950 analyzed samples of milk produced by mixed herds from different sections of the state. They reported that season influenced many of the milk constituents either directly or indirectly and that a definite trend was observed. Butterfat, total solids, serum solids, total protein, casein, ash, and calcium values were generally lower in the summer than during the winter. Lactose and potassium were higher during the summer. Sodium, chloride, magnesium, pH and titratable acidity showed no seasonal variation.

Louisiana investigators (13), during the summer months of 1951 when maximum environmental temperatures were above average and rainfall below average, found a decided drop in milk production in the University herd. Pastures were in poor condition but the animals were fed concentrates according to production. A 45 per cent decrease in milk production was observed for 24 Holstein cows and a 35 per cent decrease for 24 Jerseys. Milk production decreased sharply from May 15 (the mean maximum temperature being 85° F.) to June 15 (temperature being 90° F.) and remained at a constant low level during the months of July and August, when the temperatures averaged 90 and 96° F., respectively. Although the high environmental temperature was a main factor in this decreased milk production, poor pastures and insufficient hay may be other important factors involved.

EXPERIMENTAL PLAN

Purpose

In 1948, 1949, and 1950 experiments were conducted during the summer months to determine the effect on the mid-summer slump in milk production and on the composition of the milk of lactating cows cooled by sprinkling with water. Analyses of milks were made for fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, lactose, ash, calcium, phosphorus, specific gravity, titratable acidity, and pH values for the three years.

Methods

A. Trial I (1948)—Two comparable groups of 16 lactating cows (8 Holsteins and 8 Jerseys) were used in a reversal experiment. The design of the experiment is shown in Table 1. The cows of each breed were paired according to production, stage of lactation, and other pertinent factors. One animal of each pair was put in each group by randomization. Each group had access to similar pasture. The pasture plots were side by side on good bottom land and provided fairly good forage consisting mainly of Dallis grass with some Bermuda and a little carpet. The grass did not become dry and fibrous due to dry weather. The grain concentrate (17 per cent protein), which was made up of yellow corn meal, crimped oats, cottonseed meal, soybean meal and wheat bran with the addition of minerals and salt, was the same as that fed the regular L.S.U. milking herd and was adjusted weekly according to production.

The experiment consisted of three 14-day periods with 2 days in which to change-over between periods. The first week of the study was used as a preliminary period and the results were not recorded as part of the experiment. The average maximum temperatures taken in the pastures of both groups were 92° F., 87.5° F. and 82.3° F. for the first, second, and third periods, respectively.

In one pasture a shed (15 x 30 feet) with open sides was utilized for shade. This pasture was occupied by the group that had access to shade. Two sheds of the same size were provided in the other pasture. One of these furnished only shade and the other one was equipped with sprinklers which hung from the ceiling at regular intervals and produced a fine spray of water. A concrete floor with drainage was provided in this shed. This pasture was utilized by the group that had access to shade plus sprinkling.

B. Trial II (1949)—In this study two comparable groups of 12 lactating cows (6 Holsteins and 6 Jerseys) were used in a double reversal experiment having four 14-day periods with a preliminary period of one week. Three days were provided between periods to make the change-over. The design of the experiment is shown in Table 1.

The cows of each breed were paired according to the plan used in Trial I. Each group was fed and managed in the same manner and was subjected to either sprinkling with water or no sprinkling. The

TABLE 1.—Experimental Designs

Design of reversal experiment, Trial 1 (1948)			
Group ^a	Periods		
	1 Aug. 10-Aug. 23	2 Aug. 26-Sept. 8	3 Sept. 11-Sept. 24
1	Shade plus sprinkling	Shade	Shade plus sprinkling
2	Shade	Shade plus sprinkling	Shade
Av. max. temp.	92°F	87.5°F	82.3°F

^aEach group consisted of 8 Holstein and 8 Jersey cows.

Design of double reversal experiment, Trial 2 (1949)				
Group ^a	Periods			
	1 June 23-July 6	2 July 10-July 23	3 July 27-Aug. 9	4 Aug. 13-Aug. 26
1	Sprinkling	Shade	Sprinkling	Shade
2	Shade	Sprinkling	Shade	Sprinkling
Av. max. temp.	89.1°F	86.4°F	88.7°F	88.7°F

^aEach group consisted of 6 Holstein and 6 Jersey cows.

Design of continuous and reversal experiment, Trial 3 (1950)					
Experimental Design	Group ^a	Periods			
		1 June 26-July 9	2 July 13-July 26	3 July 30-Aug. 12	4 Aug. 16-Aug. 29
Continuous	1	Shade	Shade	Shade	Shade
Reversal	2	Shade	Sprinkling	Shade	Sprinkling
Continuous	3	Sprinkling	Sprinkling	Sprinkling	Sprinkling
Reversal	4	Sprinkling	Shade	Sprinkling	Shade
Av. max. temp.		88.4°F	87.5°F	89.2°F	89.1°F

^aEach group consisted of 3 Holstein and 3 Jersey cows.

treatments were similar to those of Trial I with the exception that the group of animals having access to the sprinklers did not have access to additional dry shade.

The average maximum temperatures were 89.1° F., 86.4° F., 88.7° F., and 88.7° F. for the first, second, third, and fourth periods, respectively.

C. Trial III (1950)—Four comparable groups of 24 cows, each consisting of 3 lactating Holsteins and 3 lactating Jerseys, were used in this experiment which consisted of a continuous and a reversal phase. The cows of each breed were paired according to stage of lactation, production, and age. One animal of each pair was placed in its respective group by randomization. The design of the experiment is shown in Table 1.

Each group was fed and managed in the same manner as those in Trials I and II. The treatments were also similar to those of Trial II with the exception that groups 1 and 3 were subjected to a continuous treatment of shade and sprinkling, respectively. This study consisted of four 14-day periods with 3 days between periods to change-over. The average maximum pasture temperatures were 88.4° F., 87.5° F., 89.2° F., and 89.1° F., for periods I, II, III, and IV, respectively.

Collection of Data—Records of milk production were kept daily for the three trials and chemical and physical analyses of milk produced by each group of cows were made daily. The analyses for fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, lactose, ash, specific gravity, titratable acidity, and pH were made according to the methods of the Association of Official Agricultural Chemists (15). The method described by Morris, Nelson and Palmer (14) was used for determining calcium and phosphorus.

RESULTS AND DISCUSSION

A. Trial I (1948)

1. Milk Production—The relationship between maximum air temperature and average daily yield of 4 per cent fat-corrected milk (FCM) of each group of cows during each period of Trial I is presented in Table 2. During period I, milk production was slightly in favor of the group of cows (group 1) which had access to sprinkling, especially the Holsteins. However, in the reversal period (period II) when this group was allowed only shade, a slightly greater milk yield still persisted over group 2 which now had access to sprinkling. In period 3, group 1 which again had access to sprinkling showed a slightly higher milk yield over group 2. Thus, this particular group of cows (group 1) produced slightly more FCM than did group 2 regardless of whether the animals were subjected to sprinkling or not.

The average milk production for group 1 during periods I and III, when the cows had access to sprinkling, was 1.3 pounds less than the milk yield during period II, when no sprinkling was available. On the other hand, group 2 produced 1.4 pounds more milk daily when the animals were subjected to sprinkling (period II) than when no sprinkling was available (periods I and III). The average daily FCM yield for all animals allowed sprinkling was 26.8 pounds as compared to 26.4 pounds for the non-sprinkled animals. The average daily milk yield for all Holsteins which were sprinkled was 26.7 pounds, while the Holsteins not sprinkled averaged 25.9 pounds. The sprinkled Jerseys averaged 27.0 pounds of milk and the non-sprinkled Jerseys 26.8. Thus sprinkling of cows appeared to have a very small effect on milk production during the summer months of 1948.

2. Composition of Milk—The average physical and chemical composition of the milk by experimental periods for Trial I is shown in Table 3. Observation of the table shows no apparent variation in the constituents of milk from cows which had access to shade and sprin-

TABLE 2.—Summary of temperature and production data of cows during each experimental period of Trial 1 (summer 1948)

Periods	1		2		3		Av. lb. of milk		Lb. of milk sprinkled cows yielded in ex- cess of cows not sprinkled
	Shade plus sprinkling	Only Shade	Shade plus sprinkling	Only Shade	Shade plus sprinkling	Only Shade	Sprinkled	Not sprinkled	
Av. maximum pasture temperature (°F.)	92.0	92.0	87.5	87.5	82.3	82.3	...	...	...
Av. Holstein and Jersey daily milk production (lb.) ^a	26.7	25.2	26.9	28.1	26.8	25.8	26.8	26.4	+4
Holstein daily milk production (lb.) ^a	26.4	24.3	25.9	28.3	27.8	25.0	26.7	25.9	+8
Jersey daily milk production (lb.) ^a	27.0	26.0	27.9	28.0	26.0	26.5	27.0	26.8	+2
a4 per cent fat-corrected milk (FCM).									

^a4 per cent fat-corrected milk (FCM).

TABLE 3.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial 1 (summer 1948)

Group	Fat %		Total solids %			Solids-not-fat %			Total protein %			Casein %			
	Periods			Periods			Periods			Periods			Periods		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
H-1 ^a	3.2	3.3	3.4	10.99	11.28	11.60	7.77	8.02	8.21	2.92	3.06	3.02	2.14	2.26	2.30
H-2 ^b	3.1	3.1	3.2	11.18	10.98	11.32	8.04	7.91	8.12	2.96	3.02	3.02	2.17	2.17	2.29
J-1 ^c	4.7	4.8	5.0	13.58	13.62	14.34	8.72	8.86	9.08	3.48	3.20	3.65	2.69	2.78	2.83
J-2 ^d	4.5	4.6	4.9	13.35	13.48	14.11	8.76	8.88	9.13	3.44	3.57	3.66	2.65	2.85	2.84
Group	Albumin %			Globulin %			Lactose %			Ash %			Calcium mg/100 ml.		
	Periods			Periods			Periods			Periods			Periods		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
H-1	.295	.286	.292	.50	.57	.61	4.59	4.71	4.69	.769	.702	.700	.098	.091	.100
H-2	.290	.221	.230	.52	.62	.52	4.63	4.66	4.54	.761	.731	.651	.094	.095	.097
J-1	.279	.237	.319	.52	.55	.52	5.11	5.11	5.03	.782	.729	.723	.109	.125	.121
J-2	.252	.193	.280	.51	.55	.54	5.08	4.99	5.05	.823	.742	.737	.110	.120	.131
Group	Phosphorus mg/100 ml.			Specific Gravity			Titratable acidity (%)			pH					
	Periods			Periods			Periods			Periods					
	1	2	3	1	2	3	1	2	3	1	2	3			
H-1	.111	.112	.119	1.0284	1.0295	1.0300	10.56	11.44	12.61	6.71	6.66	6.68			
H-2	.115	.113	.119	1.0293	1.0292	1.0294	10.83	11.72	12.39	6.69	6.63	6.66			
J-1	.127	.126	.129	1.0312	1.0316	1.0320	12.31	13.56	13.94	6.67	6.66	6.65			
J-2	.135	.131	.130	1.0316	1.0319	1.0325	12.69	13.39	14.10	6.66	6.64	6.64			
H-1—Holsteins—group 1.													J-1—Jerseys—group 1.		
H-2—Holsteins—group 2.													J-2—Jerseys—group 2.		

klings, and those that had access to only shade. The fat analyses do not show any variations as the result of sprinkling versus non-sprinkling. Group H-1 (Holsteins) for period I averaged 3.2 per cent fat while having access to sprinklers and shade, and 3.3 in period II while having access to only shade. When they were switched back to sprinklers and shade in period III, the fat rose to 3.4 per cent. This group, as well as H-2, J-1, and J-2, showed a progressive increase in fat percentage during each period of the experiment regardless of whether or not the cows had access to sprinklers.

The same progressive increase is noted with respect to total solids, solids-not-fat, total protein, casein, albumin, globulin, calcium and phosphorus, and the reversal or a progressive decrease in the lactose and ash content. It is believed that these constituents, as well as fat, are influenced by the stage of lactation and seasonal trend and not by the cooling effect of sprinkling. These results are in agreement with the work of other investigators (1, 10, 11, 12, 16, 17), in that the season of the year and stage of lactation have a definite effect on the composition of milk. However, this does not agree with work of Van Rensburg (26) in South Africa who observed that the fat and solids-not-fat content of milk from cows under investigation was at its lowest during the winter months. He found that the percentage of fat and solids-not-fat decreased progressively during a seasonal period similar to that of this trial. Davis (6) also reported that under Arizona conditions and temperatures, which reached a maximum of 105° F., environmental temperature had a greater influence on milk and butterfat production than did stage of lactation.

The range and average physical and chemical composition of milk from cows sprinkled with water and those not subjected to sprinkling for the entire experimental period of Trial I (summer 1948), regardless of their group affiliation, are shown in Appendix Table 1. The results reported in this table tend to support the observations that sprinkling apparently had no effect on the composition of the milk produced by the experimental cows. Table 4 presents the average values. The average fat percentages for the Holstein cows subjected to and not subjected to the sprinklers were similar, being 3.20 per cent. The fat percentage for the sprinkled Jersey cows was 4.77 per cent; for the Jersey cows not sprinkled it was 4.73 per cent. This is a variation of only 0.04 per cent, which is insignificant. This same trend prevailed with the other components, indicating very little variation in the composition of the milk of sprinkled and non-sprinkled cows. Appendix Table 1 also indicates a variation in the composition of milk from individual cows within breeds. The fat percentage of sprinkled Holstein cows ranged from 2.50 to 3.50 per cent and the non-sprinkled Holsteins from 2.97 to 3.80 per cent. This is a range of 1.00 and 0.83 per cent, respectively. However, as indicated previously, the average composition of milk on a herd basis within a breed was fairly uniform.

TABLE 4.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled during Trial I (summer 1948) regardless of group

Average	Holsteins		Jerseys	
	Sprinkled	Not Sprinkled	Sprinkled	Not Sprinkled
Fat %	3.20	3.20	4.77	4.73
Total solids %	11.19	11.26	13.80	13.69
Solids-not-fat %	7.96	8.06	8.89	8.92
Total protein %	2.99	3.01	3.57	3.43
Casein %	2.20	2.24	2.79	2.76
Albumin %	.27	.27	.26	.26
Globulin %	.58	.54	.53	.53
Lactose %	4.65	4.63	5.04	5.08
Ash %	7.35	7.05	7.49	7.63
Calcium mg/100 ml.	.098	.125	.117	.122
Phosphorus mg/100 ml.	.114	.115	.130	.130
Specific gravity	1.0292	1.0294	1.0817	1.0815
Titratable acidity %	11.63	11.55	13.21	13.45
pH	6.67	6.67	6.65	6.65

B. Trial II (Summer 1949)

1. **Milk Production**—A summary of the maximum environmental temperature values and production data of cows during each period of Trial II is presented in Table 5. It can be seen from the table that the cows produced slightly more milk when they were subjected to sprinkling than when they were in the shade alone with the exception of period III. The production of the Holstein cows is responsible for this increase and not that of the Jerseys. All groups, containing both Holsteins and Jerseys, which were subjected to sprinkling in each period showed an over-all daily average of 28.0 pounds of FCM during the experimental periods as compared to 27.1 pounds for the groups allowed shade. The Holsteins averaged 29.4 pounds of milk daily when allowed sprinkling as compared to 28.5 pounds when subjected to no sprinkling, a difference of 0.9 pound. The Jerseys averaged 26.6 pounds of milk when sprinkled compared with 25.7 pounds during the periods of no sprinkling, a difference of 0.8 pound. Thus sprinkling appeared to be beneficial to milk production during this summer by approximately 0.9 pound of milk.

2. **Composition of Milk**—The average physical and chemical composition of the milk analyzed during the experimental periods of Trial II is shown in Table 6. The results of this table do not follow the trend established in Table 3 for Trial I, which showed a progressive increase by periods in the percentage composition of fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, calcium and phosphorus, and a progressive decrease by periods in lactose and ash.

There was no relationship observed between the obtained values of the milk of cows subjected to and not subjected to sprinkling (Table 6). In period I, group H-1 showed a fat percentage of 3.03 when subjected to sprinkling, and 3.20 per cent in period II when subjected to

TABLE 5.—Summary of temperature and production data of cows during each experimental period of Trial II (summer 1949)

Periods Treatments	1		2		3		4		Av. lb. of milk		Lb. of milk sprinkled cows yielded in excess of cows not sprinkled
	Sprinkling	Shade	Sprinkling	Shade	Sprinkling	Shade	Sprinkling	Shade	Sprinkled	Not sprinkled	
Av. maximum pasture temperature (°F.)	89.1	89.1	86.4	86.4	88.7	88.7	88.7	88.7	...	...	.
Av. Holstein and Jersey daily milk production (lb.) ^a	29.9	29.2	29.9	28.0	25.8	26.6	26.4	24.6	28.0	27.1	.9
Holstein daily milk production (lb.)	32.0	30.1	31.7	30.1	26.9	28.4	26.8	25.5	29.4	28.5	.9
Jersey daily milk production (lb.)	27.7	28.4	28.1	26.0	24.7	24.8	26.0	23.8	26.6	25.8	.8

^a4 per cent fat corrected milk (FCM).

TABLE 6.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial II (1949)

Group	Total solids %												Solids-not-fat %			
	Fat %				Periods								Periods			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
H-1 ^a	3.03	3.20	3.22	3.19	10.74	10.86	10.91	10.52	7.70	7.66	7.68	7.32				
H-2 ^b	3.48	3.55	3.32	3.45	11.40	11.83	11.31	12.43	8.10	8.27	7.99	8.43				
J-1 ^c	4.71	4.54	4.48	4.72	13.53	13.40	13.20	12.36	8.81	8.86	8.71	8.45				
J-2 ^d	4.86	5.01	4.95	4.86	13.87	14.05	13.74	13.66	9.01	8.04	8.79	8.80				
Total protein																
Casein																
Albumin																
Group	Total protein %												Casein %			
	Periods				Periods								Periods			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
H-1	2.66	2.81	2.74	2.87	1.89	1.95	1.90	1.96	.34	.35	.34	.25				
H-2	2.78	2.94	2.83	3.02	2.04	2.26	2.07	2.25	.31	.29	.34	.20				
J-1	3.34	3.41	3.44	3.56	2.52	2.62	2.65	2.66	.33	.30	.31	.30				
J-2	3.52	3.61	3.55	3.53	2.71	2.85	2.74	2.70	.30	.29	.28	.23				

^aH-1—Holsteins, group 1, sprinkled for periods 1 and 3.

^bH-2—Holsteins, group 2, not sprinkled for periods 1 and 3.

^cJ-1—Jerseys, group 1, sprinkled for periods 1 and 3.

^dJ-2—Jerseys, group 2, not sprinkled for periods 1 and 3.

(Continued)

TABLE 6 (Continued)
The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial II (1949)

Group	Globulin %				Lactose %				Ash %				Calcium mg/100 ml.			
	Periods				Periods				Periods				Periods			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
H-1	.42	.50	.47	.66	4.5	4.5	4.5	4.5	.769	.707	.709	.659	.085	.088	.085	.087
H-2	.45	.39	.41	.56	4.9	4.9	4.8	5.0	.785	.732	.718	.672	.092	.093	.091	.094
J-1	.49	.48	.47	.60	5.1	5.0	5.0	4.7	.792	.792	.788	.708	.113	.112	.112	.114
J-2	.51	.46	.53	.54	5.1	5.0	5.0	5.1	.805	.806	.791	.724	.113	.115	.112	.114

Group	Phosphorus mg/100 ml.				Specific Gravity				Titratable Acidity %				pH			
	Periods				Periods				Periods				Periods			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
H-1	.088	.088	.089	.099	1.0284	1.0280	1.0281	1.0267	9.35	8.90	9.05	9.47	No test	No test	6.75	6.86
H-2	.088	.092	.094	.105	1.0296	1.0302	1.0293	1.0303	8.40	9.75	9.12	10.82	No test	No test	6.75	6.81
J-1	.105	.106	.108	.108	1.0315	1.0318	1.0312	1.0303	12.00	11.37	11.05	10.57	No test	No test	6.81	6.85
J-2	.110	.114	.112	.117	1.0321	1.0321	1.0312	1.0313	12.37	11.27	12.00	12.00	No test	No test	6.83	6.82

shade. This is an increase of 0.17 per cent, which follows the trend of the progressive increase as seen in Table 3. In Period III, during which the cows in group H-1 were again subjected to sprinkling, a progressive increase in fat percentage was observed, as the analysis for fat was 3.22 per cent, or an increase of 0.02 per cent. However, when the cows in this group were switched to period IV, in which the cows were subjected to dry shade, the fat content decreased to 3.19 per cent, or a reduction of 0.03 per cent. The fat percentages for the other groups, H-2, J-1, and J-2, fluctuated by periods but did not establish a definite trend between the sprinkled and non-sprinkled cows, nor for the stage of lactation and season of the year. However, total protein, casein, albumin, globulin, calcium, and phosphorus followed the seasonal trend and stage of lactation trend of progressively increasing values, whereas fat, total solids, solids-not-fat, and lactose showed no definite trend.

The range and average values of some physical and chemical constituents of milk from cows sprinkled with water and those not subjected to sprinkling during Trial II (1949) are shown in Appendix Table 2. The trend of the values in this table is comparable with those of Appendix Table 1 in that there is a wide range in the constituents of milk among individual cows within a breed while the herd average for a given breed is fairly uniform. It also establishes the fact that there is probably no variation due to sprinkling, since within the breeds the average value of any one component of milk is uniformly the same whether subjected to sprinkling or not. Any small variation is probably due to other factors.

The range of fat percentage of Jersey cows subjected to sprinklers during the four periods of Trial II is between 4.44 and 5.21, or 0.77 per cent. For Jersey cows not subjected to sprinklers the range is between 4.38 and 4.96, or a difference of 0.58 per cent fat. However, the average percentage of fat for the Jerseys subjected to sprinkling during the

TABLE 7.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled during trial II (summer 1949)

Average	Holsteins		Jerseys	
	Sprinkled	Not Sprinkled	Sprinkled	Not Sprinkled
Fat %	3.32	3.18	4.77	4.77
Total Solids %	11.48	11.07	13.61	13.34
Total Protein %	2.84	2.82	3.48	3.51
Solids-not-fat %	8.02	7.77	8.84	8.78
Casein %	2.08	2.01	2.68	2.68
Albumin %	.29	.31	.29	.37
Globulin %	.46	.51	.49	.53
Lactose %	4.71	4.69	5.07	5.01
Ash %	.721	.717	.778	.774
Calcium mg/100 ml.	.089	.090	.114	.113
Phosphorus mg/100 ml.	.094	.093	.111	.112
Specific gravity	1.0293	1.0284	1.0316	1.0314
Titratable acidity %	9.75	8.97	11.58	11.58
pH	6.78	6.81	6.82	6.84

TABLE 8.—Summary of temperature and production data during each experimental period of Trial III (summer 1950)

Periods	I			II			III			IV			Average	
Experimental Design	Continuous	Reversal		Continuous	Reversal		Continuous	Reversal		Continuous	Reversal		Continuous	Reversal
Treatment	Shade Shade plus sprinkling	Shade Shade plus sprinkling		Shade Shade plus sprinkling	Shade Shade plus sprinkling		Shade Shade plus sprinkling	Shade Shade plus sprinkling		Shade Shade plus sprinkling	Shade Shade plus sprinkling		Shade Shade plus sprinkling	Shade Shade plus sprinkling
Average maximum pasture temperature (°F.)	88.4°	88.4°	88.4°	87.5°	87.5°	87.5°	89.2°	89.2°	89.2°	89.1°	89.1°	89.1°		
Average Holstein and Jersey daily milk production ^a	28.6	30.0	29.0	30.0	31.7	27.8	31.2	33.9	28.7	24.2	27.8	24.3	28.5 (+ 2.4)	27.5 28.8 (+ 1.3)
Holstein daily milk production ^a	27.9	33.1	30.2	30.5	34.1	30.3	29.9	35.9	28.9	23.2	30.5	27.0	27.9 (+ 5.5)	30.5 29.1 (+ 1.4)
Jersey daily milk production ^a	29.3	27.0	27.8	29.6	29.4	25.4	32.4	31.8	28.4	25.8	25.4	21.7	29.3 (- 0.9)	25.8 27.1 (+ 1.3)

^aPounds of 4 per cent fat corrected milk (FCM).

four periods throughout the trial and the Jerseys not subjected to sprinkling is identical, being 4.77 per cent (Table 7). This is an indication that sprinkling had no effect on the fat percentage of the milk. The analyses of the other components reflect the same trend—a wide range in composition among individual animals and a uniform average of milk constituents for a given herd.

C. Trial III (Summer 1950)

1. **Milk Production**—Table 8 presents the values of average maximum air temperature and average FCM production during each experimental period of Trial III. There is apparently no close relationship between milk production of the cows and the environmental temperatures. Examination of the table shows that the average milk production for both Holstein and Jersey cows which had access to sprinkling is greater than the average production of the animals not having access to sprinkling, regardless of the type of trial. The Holsteins having access to sprinkling had a higher daily milk yield by 3.5 pounds, on the average, over the non-sprinkled Holsteins. In analyzing the values obtained during each trial it is seen that the Holsteins subjected to sprinkling showed an average daily increase of 5.5 pounds more milk during the continuous trial and an increase of 1.4 pounds during the reversal trial over the production of Holsteins not subjected to sprinkling. For the Jerseys, those sprinkled produced an average of 1 pound less milk than those not sprinkled in the continuous trial but 1.3 pounds more in the reversal. The average maximum pasture temperature failed to reach 90° F. during this trial and the results may have been different if it had reached the middle nineties, which might have restricted grazing, especially in the Holstein breed.

2. **Composition of Milk**—The average physical and chemical constituents of the milk analyzed during each experimental period of Trial III is shown in Table 9. The results in this table indicate that there is probably no variation in the composition of milks produced by cows subjected to continuous shade or sprinkling, or of those subjected to a reversal of shade and sprinkling. The general trend of variation, with a few exceptions, follows those in Trial I (1948) of a progressive increase in fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, calcium, and phosphorus, and a decrease in lactose and ash. In the reversal trial, the fat percentage for group H-2 in period I was 2.70 when subjected to shade. When reversed to sprinkling in period II the fat percentage increased to 2.91. In period III when the cows again had access to shade the fat percentage remained at about the same level (2.95 per cent). In period IV (when the cows were reversed to sprinkling) the fat percentage continued to increase to 3.20. The Jersey breed of this group, J-2, also shows a progressive increase in fat percentage for periods, I, II, and III but a small decline of 0.10 per cent in the fourth period as compared to the third period. The continuous groups 1 and 3 parallel the progressive increase in fat of groups 2 and 4. These results

TABLE 9.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial III (1950)

Period	Group	Fat	Total Solids	Solids-not-fat	Total protein	Casein	Albumin	Globulin	Lactose	Ash	Calcium mg/100 ml.
		%	%	%	%	%	%	%	%	%	
I	H-1 ^a	2.20	10.19	8.14	2.75	1.86	.29	.60	4.9	.792	.093
	J-1 ^a	4.50	13.15	8.65	3.48	3.12	.22	.14	5.0	.769	.112
	H-2 ^b	2.70	10.96	8.26	2.78	2.01	.31	.46	4.5	.768	.093
	J-2 ^b	4.92	14.25	9.33	3.52	2.78	.23	.51	5.1	.788	.114
	H-3 ^c	3.00	11.25	8.25	2.92	1.95	.36	.63	4.6	.805	.095
	J-3 ^c	3.80	12.18	8.38	3.64	2.68	.37	.59	5.0	.801	.113
	H-4 ^d	2.80	10.98	8.18	2.84	1.98	.31	.55	4.8	.762	.096
	J-4 ^d	4.58	13.30	8.72	3.51	2.73	.34	.44	5.1	.798	.110
	H-1	2.93	11.24	8.31	2.72	1.98	.33	.41	4.7	.760	.098
	J-1	4.80	13.51	8.71	3.31	2.92	.31	.08	4.9	.820	.109
II	H-2	2.91	11.27	8.33	2.90	2.45	.30	.15	4.8	.680	.096
	J-2	5.13	14.13	9.00	3.63	3.10	.32	.21	5.1	.780	.111
	H-3	3.13	11.23	8.10	3.30	2.25	.28	.77	4.6	.720	.100
	J-3	4.41	13.02	8.60	3.56	3.06	.29	.21	5.0	.690	.106
	H-4	3.10	11.44	8.34	2.96	2.36	.31	.29	4.4	.760	.105
	J-4	4.59	13.23	8.64	3.59	2.79	.29	.51	4.8	.710	.115

^aH-1 Holsteins—Continuous trial—not sprinkled.

J-1 Jerseys—Continuous trial—not sprinkled.

^bH-2 Holsteins—Reversal trial—Period 1, not sprinkled; 2, sprinkled; 3, N. S.; 4, S.

J-2 Jerseys—Reversal trial—Period 1, not sprinkled; 2, sprinkled; 3, N. S., 4, S.

^cH-3 Holsteins—Continuous trial—sprinkled.

J-3 Jerseys—Continuous trial—sprinkled.

^dH-4 Holsteins—Reversal trial—1, sprinkled; 2, N. S.; 3, S.; 4, N. S.

J-4 Jerseys—Reversal trial—1, sprinkled; 2, N. S.; 3, S.; 4, N. S.

(Continued)

TABLE 9. (Continued).—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial III (1950)

Period	Group	Fat %	Total Solids %	Solids- not-fat %	Total protein %	Casein %	Albumin %	Globulin %	Lactose %	Ash %	Calcium mg/100 ml.
III	H-1	3.15	11.45	8.30	2.85	2.13	.30	.42	4.9	.710	.115
	J-1	5.50	14.25	8.75	3.55	3.05	.26	.24	5.0	.730	.112
	H-2	2.95	11.46	8.51	2.73	1.95	.28	.50	5.0	.690	.120
	J-2	5.55	14.36	8.81	3.39	2.95	.30	.14	4.9	.780	.119
	H-3	3.55	11.21	7.66	3.05	2.06	.29	.70	4.8	.680	.115
	J-3	5.15	13.38	8.23	3.50	3.12	.25	.13	5.1	.750	.113
	H-4	3.25	10.67	7.42	2.97	2.15	.30	.52	4.9	.710	.114
	J-4	5.45	14.62	9.14	3.61	3.15	.28	.18	4.7	.760	.108
IV	H-1	3.10	11.07	7.97	3.00	2.10	.28	.62	4.6	.780	.105
	J-1	4.95	14.06	9.11	3.50	2.85	.26	.39	5.1	.790	.111
	H-2	3.20	11.11	8.01	2.96	1.98	.31	.67	4.8	.590	.098
	J-2	5.45	14.59	9.14	3.36	2.96	.24	.16	4.8	.720	.106
	H-3	3.50	11.47	7.97	2.85	2.00	.28	.57	4.8	.650	.097
	J-3	5.20	13.39	8.69	3.45	2.85	.30	.30	4.7	.810	.109
	H-4	3.40	11.13	7.73	2.73	1.90	.28	.55	4.7	.680	.102
	J-4	5.20	13.36	8.16	3.53	3.05	.26	.22	5.0	.790	.113

(Continued)

TABLE 9.—(Continued).—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled for each experimental period during Trial III (1950)

Period	Group	Phosphorus mg/100 ml.	Specific gravity	Titratable acidity %	pH
I	H-1	.089	1.0302	10.75	6.49
	J-1	.105	1.0310	14.00	6.46
	H-2	.092	1.0309	12.00	6.26
	J-2	.108	1.0334	13.50	6.47
	H-3	.096	1.0306	11.32	6.28
	J-3	.106	1.0305	12.12	6.39
	H-4	.093	1.0305	13.50	6.40
	J-4	.105	1.0312	12.95	6.43
II	H-1	.101	1.0309	11.82	6.63
	J-1	.115	1.0310	15.75	6.62
	H-2	.095	1.0311	12.70	6.59
	J-2	.109	1.0319	15.22	6.65
	H-3	.109	1.0299	12.00	6.64
	J-3	.113	1.0309	14.50	6.62
	H-4	.116	1.0309	13.80	6.67
	J-4	.120	1.0309	14.25	6.63
III	H-1	.111	1.0307	13.37	6.57
	J-1	.108	1.0306	15.25	6.25
	H-2	.101	1.0317	13.25	6.57
	J-2	.115	1.0308	13.75	6.60
	H-3	.112	1.0278	12.62	6.50
	J-3	.099	1.0288	12.50	6.60
	H-4	.108	1.0271	13.37	6.60
	J-4	.115	1.0322	14.62	6.45
IV	H-1	.105	1.0294	11.75	6.60
	J-1	.109	1.0325	16.00	6.51
	H-2	.096	1.0295	13.2	6.63
	J-2	.111	1.0322	14.25	6.58
	H-3	.093	1.0291	12.00	6.62
	J-3	.099	1.0310	13.37	6.64
	H-4	.108	1.0282	13.50	6.61
	J-4	.105	1.0285	14.12	6.60

indicate that the variation was not the result of sprinkling or shade but could be attributed to the stage of lactation and season of the year or other factors.

The average physical and chemical composition of milks produced by each experimental group of cows during Trial III (summer 1950) is shown in Table 10. The values indicate that there was no variation in the composition of milk as a result of sprinkling the experimental cows with water. The average for all Holsteins not sprinkled, which included those in the continuous and reversal trials, as compared with the average for all Holsteins sprinkled is remarkably close in the percentage of all constituents. The fat percentage for the Holsteins had the widest range—0.22 per cent. This same observation in percentage of all constituents is noted between all non-sprinkled Jerseys and all sprinkled Jerseys. The greatest range—0.22 per cent—was in total solids. This is

TABLE 10.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled in each experimental group by treatment during Trial III (summer (1950)

Group and Treatment	Fat	Total solids	Solids-not-fat	Total protein	Cascin	Albumin	Globulin	Lactose	Ash	Calcium mg/100 ml.	Phosphorus mg/100 ml.
	%	%	%	%	%	%	%	%	%		
H-Dry (C) ^a	2.84	10.99	8.18	2.83	2.02	.30	.51	4.8	.760	.103	.101
H-Dry (R) ^b	3.04	11.18	8.21	2.80	2.05	.29	.45	4.6	.724	.106	.104
H-Wet (C) ^c	3.29	11.29	7.99	3.03	2.06	.30	.67	4.7	.714	.102	.101
H-Wet (R)	3.04	11.00	7.98	2.92	2.14	.30	.47	4.8	.710	.101	.101
J-Dry (C&R)	2.94	11.08	8.19	2.81	2.03	.29	.48	4.7	.742	.104	.102
J-Wet (C&R)	3.16	11.14	7.98	2.97	2.10	.30	.57	4.7	.712	.101	.101
J-Dry (C)	4.94	13.74	8.80	3.46	2.98	.26	.21	5.0	.777	.111	.109
J-Dry (R)	5.06	13.80	8.73	3.51	2.89	.27	.34	4.9	.767	.115	.113
J-Wet (C)	4.64	12.99	8.47	3.54	2.93	.30	.31	4.9	.763	.110	.104
J-Wet (R)	5.15	14.16	9.00	3.53	2.98	.29	.25	4.9	.764	.109	.110
J-Dry (C&R)	5.00	13.77	8.76	3.48	2.93	.26	.27	4.9	.772	.113	.111
J-Wet (C&R)	4.89	13.57	8.73	3.53	2.95	.29	.28	4.9	.763	.109	.107

^aC—Continuous.

^bR—Reversal.

(Continued)

TABLE 10.—(Continued).—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled in each experimental group by treatment during Trial III (summer 1950)

Group and Treatment	Specific gravity	Titrateable acidity	pH
		%	
H-Dry (C)	1.0303	11.92	6.57
H-Dry (R)	1.0304	13.14	6.53
H-Wet (C)	1.0293	11.98	6.51
H-Wet (R)	1.0295	13.17	6.55
H-Dry (C&R)	1.0303	12.53	6.55
H-Wet (C&R)	1.0294	12.57	6.53
J-Dry (C)	1.0313	15.25	6.46
J-Dry (R)	1.0309	13.90	6.57
J-Wet (C)	1.0303	13.12	6.56
J-Wet (R)	1.0321	14.26	6.53
J-Dry (C&R)	1.0311	14.57	6.51
J-Wet (C&R)	1.0312	13.69	6.54

C—Continuous.

R—Reversal.

an indication that sprinkling of the experimental animals had little, if any, effect on the composition of milk.

The average maximum environmental temperatures during summer trials of 1948, 1949, and 1950, are very similar. In general, these figures are between 85° and 90° F. The 1948 trial was started later (August) than the 1949 and 1950 trials (June). No relationship was found between the environmental temperatures and amount of milk production or milk composition for any of the years studied. No advantage in sprinkling the animals occurred during the first trial during 1948. In the 1949 trial, sprinkling increased the average daily milk production of the animals by 0.9 pound, which was not important. In the 1950 trial, sprinkling increased the milk production of Holsteins by a significant figure, 5.5 pounds daily, during the continuous trial. From this study daily sprinkling during the hot months appears to be of benefit to Holsteins. Ragsdale *et al.* (18, 20) have pointed out the sensitivity of Holstein animals to high environmental temperatures. Rectal temperatures and respiratory activity increased while milk production decreased at a greater rate than for Jerseys. Thus sprinkling may be of advantage in the comfort of Holstein cows.

The lack of control of some of the variables encountered under pasture conditions may have been an important factor in these studies. The environmental temperature as well as the humidity was always changing. Wind velocity, though low, probably varied in its effect on the cows' comfort. It is possible that animals recover from the high day-time temperatures after the sun sets. Holstein cattle, being more sensitive, might not recuperate or become acclimatized as quickly as it appears Jersey cattle do at Louisiana temperatures.

TABLE 11.—The average physical and chemical composition of milk from cows sprinkled with water and not sprinkled, by breeds, during Trials I (1948), II (1949), III (1950) and the three year averages during the summer months

Trial	Breed	Fat %	Total solids %	Solids- not- fat %	Total protein %	Casein %	Albumin %	Globulin %	Lactose %	Ash %	Calcium mg/100 ml.
1948	Holstein	3.20	11.20	8.01	3.00	2.22	.27	.56	4.64	.720	.096
1949	Holstein	3.25	11.27	7.89	2.83	2.04	.30	.48	4.70	.719	.089
1950	Holstein	3.05	11.11	8.08	2.89	2.06	.29	.52	4.70	.727	.102
Av.	Holstein	3.17	11.20	7.99	2.91	2.11	.29	.52	4.68	.722	.096
1948	Jersey	4.75	13.74	8.90	3.50	2.77	.26	.53	5.06	.756	.119
1949	Jersey	4.77	13.47	8.81	3.49	2.68	.33	.51	5.04	.776	.113
1950	Jersey	4.94	13.67	8.74	3.50	2.94	.27	.27	4.90	.767	.111
Av.	Jersey	4.82	13.63	8.82	3.50	2.80	.29	.44	5.00	.766	.114

Trial	Breed	Phosphorus mg/100 ml.	Specific gravity	Titratable acidity %	pH
1948	Holstein	.114	1.0293	11.59	6.67
1949	Holstein	.093	1.0288	9.36	6.79
1950	Holstein	.101	1.0298	12.55	6.54
Av.	Holstein	.103	1.0293	11.17	6.67
1948	Jersey	.130	1.0316	13.33	6.65
1949	Jersey	.111	1.0315	11.58	6.78
1950	Jersey	.109	1.0311	14.13	6.52
Av.	Jersey	.117	1.0314	13.01	6.65

Table 11 summarizes the average physical and chemical composition of milk from Holstein and Jersey cows sprinkled with water and those not sprinkled, during the three summer periods—Trial I (1948), Trial II (1949), and Trial III (1950)—and also the three-year averages. These values for the various years are very close, and again indicate that the composition of cow's milk of an individual breed is fairly constant.

SUMMARY

During the summer months of 1948, 1949, and 1950 experiments were conducted to determine what effect cooling of lactating cows by shade or by sprinkling with water had on milk production and on the composition of the milk. Analyses were made for fat, total solids, solids-not-fat, total protein, casein, albumin, globulin, lactose, ash, calcium, phosphorus, specific gravity, titratable acidity, and pH of the milk for each year.

In 1948 a reversal trial was run using two groups of 16 lactating animals (8 Holsteins and 8 Jerseys); in 1949 a double reversal trial involving two groups of 12 lactating animals (6 Holsteins and 6 Jerseys); and in 1950 a double reversal and continuous trial involving 24 lactating animals (12 Holsteins and 12 Jerseys).

The results obtained for the three-year study indicate:

- 1). There was a slight increase in milk production of the Holstein cattle that were subjected to sprinkling over the production of the cows not subjected to sprinkling, especially during the continuous trial when the animals were sprinkled daily. There was practically no increase in the milk production of the sprinkled Jersey cows over that of the Jerseys not sprinkled.
- 2). There was no relationship between the average daily maximum environmental temperature (88° F.) and the composition of the milk for the three trials.
- 3). Any cooling effect of the animals from sprinkling had little, if any, effect on the physical and chemical constituents in milk.
- 4). The average physical and chemical composition of the milk from the experimental cows in the trials over the three-year period is within a 10 per cent variation when compared with the average values reported by other workers in the United States and foreign countries. The values recorded by other investigators are consistently higher in the physical and chemical composition of milk with the exception of ash and lactose.

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APPENDIX TABLE 1.—The range and average physical and chemical composition of milk from cows sprinkled with water and not sprinkled during Trial 1 (summer 1948) regardless of group

Group	Fat %		Total solids %		Solids-not-fat %		Total protein %		Casein %	
	Range		Range		Range		Range		Range	
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Min.	Max.
H- (wet) ^a	2.50	3.50	3.20	10.33	11.19	6.99	8.43	7.96	2.72	2.06
H- (dry)	2.97	3.80	3.20	10.45	11.86	7.53	9.99	8.06	2.63	2.03
J- (wet) ^b	4.00	5.30	4.77	12.70	15.80	13.80	8.68	10.54	8.89	3.28
J- (dry)	4.27	5.00	4.73	12.34	14.20	13.69	8.35	9.44	8.92	3.31
Group	Albumin %		Globulin %		Lactose %		Ash %		Calcium mg/100 ml.	
	Range		Range		Range		Range		Range	
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Min.	Max.
H- (wet)	.13	.47	.27	.39	.76	.58	4.22	4.80	.735	.085
H- (dry)	.15	.43	.27	.36	.69	.54	4.00	4.80	.705	.074
J- (wet)	.11	.38	.26	.39	.70	.53	4.60	5.30	.749	.079
J- (dry)	.14	.40	.26	.35	.88	.53	4.95	5.20	.763	.091
Group	Phosphorus mg/100 ml.		Specific gravity		Titratable acidity %		pH			
	Range		Range		Range		Range			
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Min.	Max.
H- (wet)	.094	.138	.114	1.0273	1.0306	1.0292	10.00	14.50	11.63	6.80
H- (dry)	.097	.142	.115	1.0253	1.0306	1.0294	10.00	14.00	11.55	6.77
J- (wet)	.107	.165	.130	1.0802	1.0384	1.0817	12.00	15.00	13.21	6.65
J- (dry)	.113	.172	.130	1.0298	1.0330	1.0815	11.70	15.50	13.45	6.80

^aHolsteins

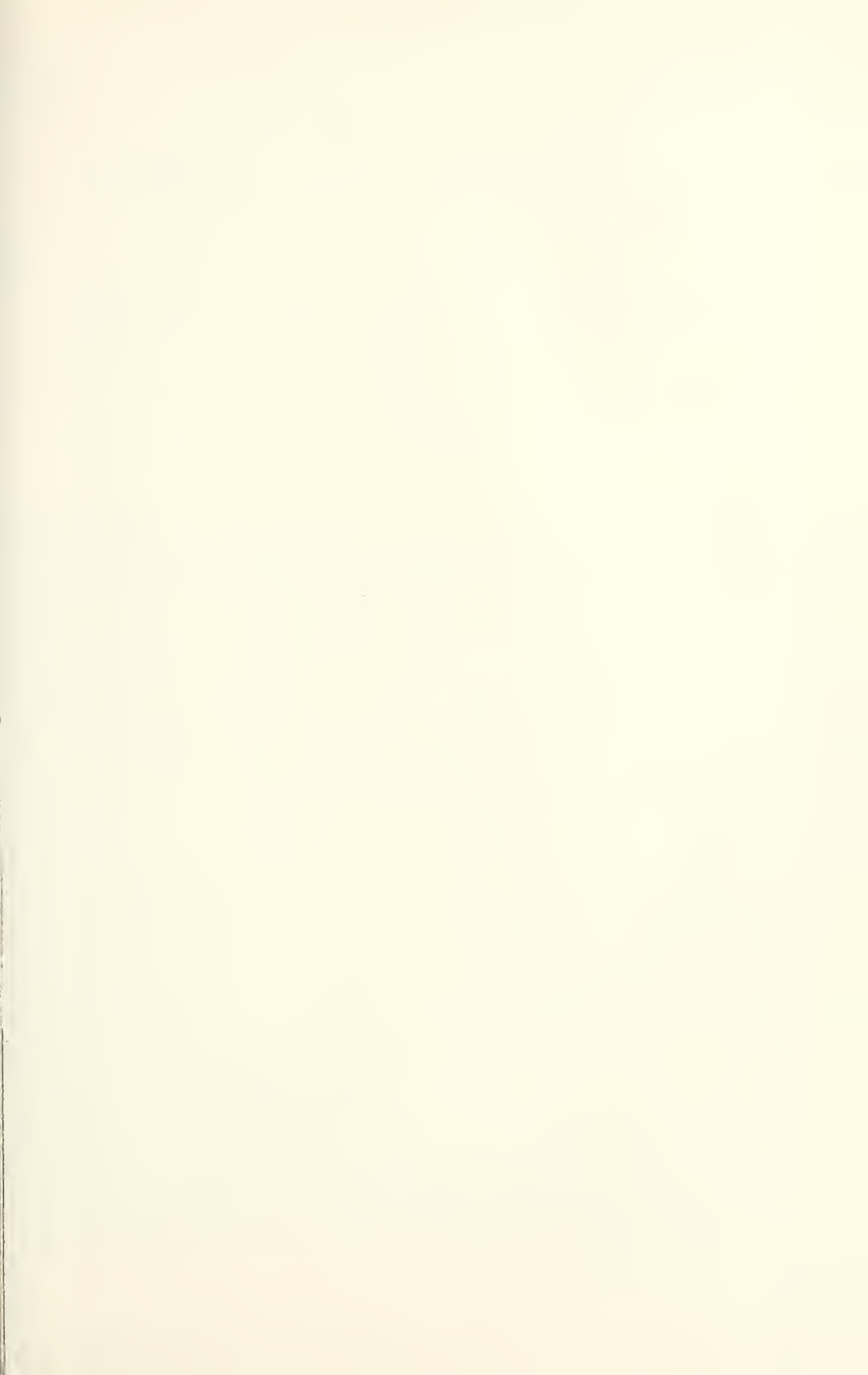
^bJerseys

APPENDIX TABLE 2.—The range and average physical and chemical composition of milk from cows sprinkled with water and not sprinkled during Trial II (summer 1949)

Group	Fat %			Total solids %			Solids-not-fat %			Total protein %			Casein %		
	Range			Range			Range			Range			Range		
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.
H-(wet) ^a	2.97	3.71	3.32	10.61	13.51	11.48	7.64	8.78	8.02	2.68	3.05	2.84	1.84	2.34	2.08
H-(dry)	3.06	3.57	3.18	10.50	11.66	11.07	7.17	8.26	7.77	2.74	2.92	2.82	1.90	2.10	2.01
J-(wet) ^b	4.44	5.21	4.77	13.16	14.13	13.61	8.71	9.16	8.84	3.26	3.70	3.48	2.44	3.46	2.68
J-(dry)	4.38	4.96	4.77	11.76	13.99	13.34	8.14	9.08	8.78	3.34	3.64	3.51	2.62	2.78	2.68
Group	Albumin %			Globulin %			Lactose %			Ash %			Calcium mg/100 ml.		
	Range			Range			Range			Range			Range		
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.
H-(wet)	.20	.36	.29	.34	.72	.46	4.40	5.05	4.71	.668	.783	.721	.083	.096	.089
H-(dry)	.25	.37	.31	.33	.72	.51	4.30	4.90	4.69	.651	.795	.717	.095	.084	.090
J-(wet)	.19	.33	.29	.41	.55	.49	5.00	5.10	5.07	.701	.817	.778	.109	.119	.114
J-(dry)	.23	.34	.37	.39	.63	.53	4.70	5.10	5.01	.708	.814	.774	.112	.115	.113
Group	Phosphorus mg/100 ml.			Specific gravity			Titratable acidity %			pH					
	Range			Range			Range			Range					
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.			
H-(wet)	.085	.110	.094	1.0278	1.0313	1.0293	8.50	12.25	9.75	6.73	6.85	6.78			
H-(dry)	.084	.109	.093	1.0260	1.0303	1.0284	7.40	10.55	8.97	6.75	6.87	6.81			
J-(wet)	.102	.126	.111	1.0310	1.0328	1.0316	9.55	13.00	11.58	6.78	6.85	6.82			
J-(dry)	.105	.130	.112	1.0298	1.0324	1.0314	10.40	12.40	11.58	6.77	6.89	6.84			

^aHolsteins

^bJerseys





he Value of Pastures n Rotation with Rice

by David E. Black and R. K. Walker



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The Value of Pastures in Rotation With Rice

DAVID E. BLACK AND R. K. WALKER

INTRODUCTION

The major portion of the Louisiana rice industry is located in the coastal prairie area of southwest Louisiana and comprises chiefly seven parishes that produce 89 per cent of the rice grown in the state. The agricultural economy of this section is built almost exclusively on the production of rice and beef cattle.

Because of the present practices of short-time rotation, low rate of fertilization and the flooding and draining associated with rice cultivation, the soils have become particularly low in organic matter, nitrogen and phosphorus (7, 8) *. In some cases the soils are so infertile that rice yields are less than 35 bushels per acre. This yield is not considered high enough for profitable rice farming.

The most common rotation practice is to plant half the farm to rice each year, with the other half being used as native pasture for beef cattle. It requires from five to six acres of this native or weedy fallow type of pasture plus rice stubble and some concentrate feed to support one mature animal. Beef production per acre is approximately 50 pounds annually (2). This practice when continued year after year results in poor livestock returns, lower rice yields and a general reduction in the fertility of the rice soils. Some farmers find it more profitable to graze their land for two years before planting it back to rice, while a few graze as long as three or four years.

Because of the noncompetitive nature of rice and beef cattle production, these two enterprises fit very well together and one tends to add to or supplement the other. It has been known for years (1) that a sound rotation program of pastures with other crops tends to build up soil organic matter, available nitrogen, and other plant nutrients. With the increasing need for more and better livestock feed in this area, a rotation system of improved pastures with rice seemed to be the logical approach to increasing the rice yields and building up the general fertility level of the rice soils. Therefore a series of experiments along this line was begun in 1938 and continued to date. A report of the early work up to 1945 is presented in Louisiana Experiment Station Bulletin 407, "A Twelve-Month Grazing Program for the Rice Area of Louisiana."

Information on the value of improved pastures in rotation with rice is somewhat limited. However, earlier work done in Louisiana, 1939 - 1945 (2), showed that good results could be obtained by the use of improved pastures. Beef yields were increased from approximately 50

* Figures in parentheses refer to "Literature Cited."

pounds to 250 pounds per acre and rice yield increases following improved pastures varied from 6.4 to 11.1 barrels per acre. Weihing, Moncrief, and Davis report (3) that beef yields on fallow land were 46.9 pounds per acre, while improved pastures produced 181.7 pounds per acre and rice yields following three years of improved pastures averaged 17.72 barrels per acre as compared to 15.23 barrels per acre on land planted to rice every other year with no pasture improvement. Davis reports (4) a common rotation that is followed on lighter soils in California is rice, beans, wheat, beans and again to rice. Jones *et al.* (5) report that attempts have been made at the Biggs Rice Field Station to grow cultivated crops such as corn, grain sorghums, cotton and beans in rotation with rice, but profitable crops have not been produced. They also state that with good stands the yields of rice on improved pasture lands are relatively high, but the most common rotation in California is to alternate a rice crop and fallow, with such idle lands often being pastures. Nelson reports (6) that a two-year rotation of rice with soybeans harvested as hay or beans, or turned under for soil improvement, is more desirable than rice rotated with fallow because no income is produced from the land the year in which it is fallowed. Many crops used in some other states are not grown in rotation with rice in southwest Louisiana because they are not adapted to the climatic and soil conditions existing in this area. Improved pastures accompanied by supplemental grazing crops such as oats, wheat, rye grass, lespedeza and clovers have proved to be more desirable for rotation with rice in Louisiana.

EXPERIMENTAL PROCEDURE

A five-year rotation experiment was established at five locations from 1946 to 1953 on four different soil types in the rice area, in a continuation of the investigations begun in 1938. The purpose of these experiments was to determine the effects of improved pasture compared with native pastures on rice and beef yields and, at the same time, determine whether a year-round grazing program for maximum beef production in a pasture-rice rotation was practical. The plan consisted of three years in pasture followed by two in rice. The individual experiments included three treatments, with two or three replications of each treatment, replicates in the experiments at the different locations varying in size from five to ten acres. The three initial pasture treatments were as follows:

(1) Improved pasture. This pasture was limed where necessary to bring the pH to 6.2, fertilized with 400 pounds of 3-12-12 fertilizer per acre. It was seeded with 5 pounds of white clover, 10 pounds of common or 15 pounds of Kobe lespedeza and 16 pounds of Dallis grass per acre. Bermuda grass is native and volunteered in all pastures. Two hundred pounds of 3-12-12 fertilizer per acre was applied as topdressing in the fall of the second and third year.



Top picture: Heavily grazed improved pasture. (Photo taken April 27, 1948, on the Joe Zaunbrecher farm, Gueydan, La.) Bottom picture: Check pasture, showing native weeds and grass commonly found in the rice area.

(2) Oats-lespedeza supplementary pasture and hay crop. This pasture was fertilized each fall with 300 pounds of 5-10-5 fertilizer per acre and seeded with three bushels of oats per acre. Thirty-two pounds of nitrogen per acre was added as a topdressing about February 15, at which time the oats were over-planted with Kobe lespedeza at the rate of 25 pounds per acre.

(3) Check or unimproved pasture. This pasture was not plowed, seeded or fertilized, but was fallow to native weeds and grasses. All pastures were mowed when necessary to control weeds.

The pastures were grazed for three years with as many cattle as they would support and for as long a period as normal grazing was available. Cattle weights were recorded every 30 days.

After three years of grazing, all of the plots were plowed in early winter and planted to rice the following spring. One replication of each pasture was planted to rice in six plots. Three of the six plots planted to rice were fertilized with 200 pounds of 4-12-8 fertilizer per acre. Three plots were planted to rice but not fertilized. These plots were planted for two years and rice yields from fertilized and non-fertilized plots after pasture were obtained.

EXPERIMENTAL RESULTS

Rice Experiment Station, Crowley, Louisiana

This experiment was begun in 1949 on Crowley silt loam at Crowley, Louisiana. There was a total of 45 acres in the test, with three replications of five acres each and three treatments as indicated above. Grazing data are presented in Table 1. The average number of grazing days per year for the check pasture was 201, while that of the improved pasture was 243 days. The difference in grazing days was comparatively less than the difference in carrying capacity, which was 0.22 animal units* per acre for the check pasture and 0.54 for the improved pasture. The three-year average beef production per acre per year was 45 pounds on the check pasture and 224 on the improved pasture.

The seasonal distribution of beef gains is presented as an average for three years in Figure 1. Grazing on improved pastures began each year between February 16 and February 26, while on the check pastures grazing was not available until one to two months later. The beef production per acre on the improved pastures was high during the months of March, April and May owing to the excellent growth of white clover during this period. A sharp decline occurred in June, a period during which dry weather is usually encountered and clover growth is halted. The lespedeza and Dallis grass coming in after the peak of the clover growth tended to stabilize beef production around 15-20 pounds per acre per month until October 1, when better moisture conditions

* "Animal units" represents 1,000 pounds of animal weight.

TABLE 1.—Summary of grazing data from pastures at five locations, 1946-1952

Location of Experiment	Pasture	Days grazing per year			Average number animal units grazed per acre				Beef production—lbs. per acre				
		First year	Second year	Third year	Three year average	First year	Second year	Third year	Three year average	First year	Second year	Third year	Annual average
Rice Experiment Sta.	Check	242	169	201	201	.18	.27	.20	.22	49	60	27	45
	Improved	254	217	260	243	.44	.56	.62	.54	126	284	264	224
E. O. Daughenbach	Check	67	133	128	109	.69	.35	.24	.43	-6	73	49	40
	Improved	110	238	165	171	.65	.54	.46	.55	230	265	227	240
Karl Goebel	Check	51	74	204	110	.26	.26	.30	.27	58	36	81	58
	Improved	110	223	255	196	1.11	.63	.74	.82	235	403	432	356
Joe Zaunbrecher	Check	...	84	61	73	...	.22	.27	.24	...	45	27	36*
	Improved	...	144	213	178	...	.45	.53	.49	...	160	208	184*
A. M. Moore	Check	...	220	75	148	...	.45**	.30	.38	...	52	49	51*
	Improved	...	220	153	187	...	1.00**	.57	.79	...	367	327	347*
Average	Check	120	136	133	130	.37	.28	.26	.30	36	53	46	46
	Improved	158	208	209	192	.73	.54	.58	.63	197	295	292	271

* Two-year average.

** Animals per acre. Data on animal units per acre not available.

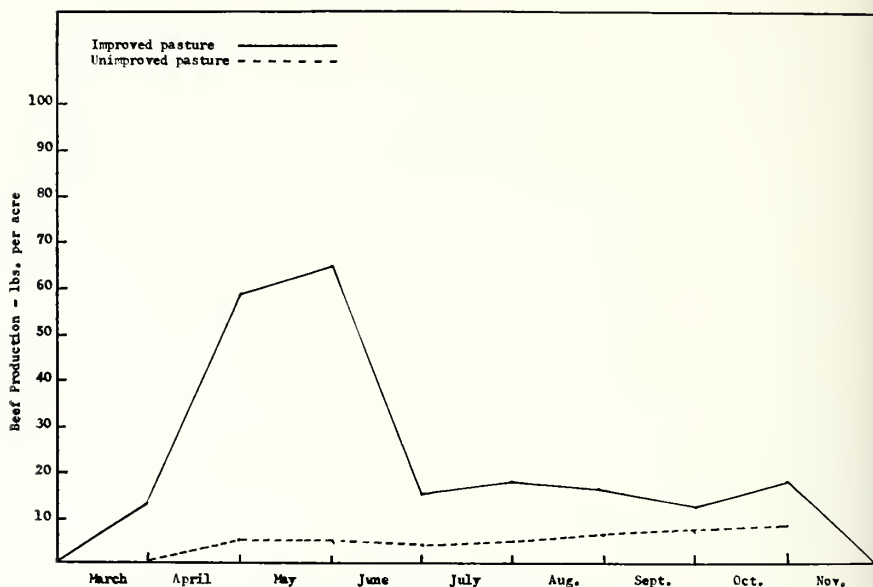


FIGURE 1.—Seasonal distribution of beef gains from pastures on Crowley silt loam at the Rice Experiment Station, Crowley, Louisiana, 1950 - 1952.



Improved pasture after 360 days continuous grazing on the Rice Experiment Station, Crowley, La. (Photo taken Jan. 25, 1955.)

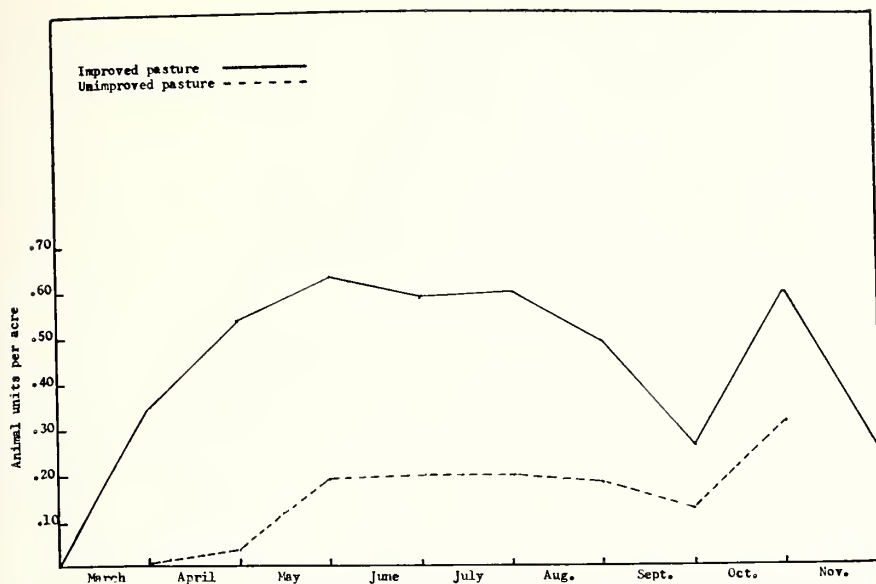


FIGURE 2.—Seasonal distribution of grazing capacity of pastures on Crowley silt loam at the Rice Experiment Station, Crowley, Louisiana, 1950 - 1952.

caused a slight increase in production. The beef production on the check pastures, although extremely low, did not vary from month to month as much as on the improved pastures. The average grazing capacities for the three-year period, in animal units per acre, of each of the two pastures are presented in Figure 2 and show the same general trend as beef production per acre presented in Figure 1.

The oat-lespedeza pasture was used for supplementary grazing and grain production for feed during pasture shortages during both summer and winter and also for hay production to further supplement grazing during the winter months. Oats were grazed an average of 81 days per year with 0.55 animal units per acre, and the production of beef was 55 pounds per acre per year for the three-year period. Year-round grazing was obtained during two of the three years from a combination of improved pasture and supplementary pasture. During one year the combination of improved pasture and oat-lespedeza supplementary pasture supported one animal per acre for nine months and 0.7 animal per acre for three winter months, with the animals gaining an average of 1.4 pounds per acre per day for the entire year. An average of 27.6 bushels of oats and 1.5 tons of lespedeza hay per acre per year were harvested from these plots in addition to the beef produced from grazing.

Rice yields following these pastures are shown in Table 2. For the first year the yield of fertilized rice following improved pastures was 22.91 barrels per acre as compared to 18.96 for the non-improved pastures. The

TABLE 2.—Summary of rice yields following pastures at four locations, 1946-1952

Location of Experiment	Yield of rice, bbls. per acre—dry weight (14% moisture)							
	Following improved pasture				Following check pasture			
	200 lbs. per acre 4-12-8		No fertilizer used		200 lbs. per acre 4-12-8		No fertilizer used	
	First year	Second year	First year	Second year	First year	Second year	First year	Second year
Karl Goebel	26.03	16.82	25.00	15.38	22.20	14.90	20.60	14.01
Joe Zaunbrecher	25.64	16.27	22.60	14.91	18.35	11.84	17.75	10.26
A. M. Moore	19.20	16.00	19.00	16.02	15.30	11.80	13.00	10.83
Rice Experiment Station	22.91	12.44	23.31	11.73	18.96	14.02	16.28	11.90
Average	22.94	15.38	22.47	14.51	18.70	13.14	16.90	11.75
Average yield increase from fertilizer	0.47	0.87			1.80	1.39		
Average yield increase from sod and fertilizer	6.04	3.63						



Top picture: Winter grazing on oat pasture at the Rice Experiment Station, Crowley, La. Bottom picture: Winter grazing on rice stubble. (Both photos taken Jan. 25, 1955.)

fertilizer had no effect on the rice yield following improved pastures but it increased rice yield following the unimproved pastures by 2.68 barrels. The rice after improved pastures produced 7.03 barrels per acre more than rice after the unimproved pastures. The second year rice yields were very low and data are not considered to be of any value because of poor stands and heavy weed and grass infestation.

E. O. Daughenbach Farm, Lake Charles, Louisiana

This experiment was begun in the summer of 1948 on Lake Charles silty clay loam at Lake Charles, Louisiana. The experimental area consisted of 48 acres and included three treatments with two replications. The treatments were the same as outlined in the experiment at Crowley. Grazing data are presented in Table 1. The average number of days of grazing per year over the three-year period was 109 for the check pasture and 171 for the improved pasture. There was a loss of six pounds of beef per acre during the first year of grazing on the check pasture, while the improved pasture produced 230 pounds of beef per acre. The three-year average gain from the check pasture was 40 pounds per year, while the improved pasture produced 240 pounds of beef per acre per year.

The seasonal distribution of beef gains per acre (Figure 3) on the improved pasture shows the same general curve as at the Crowley location, with high production in April and May followed by low production in July and August. The check pasture furnished no grazing in any of

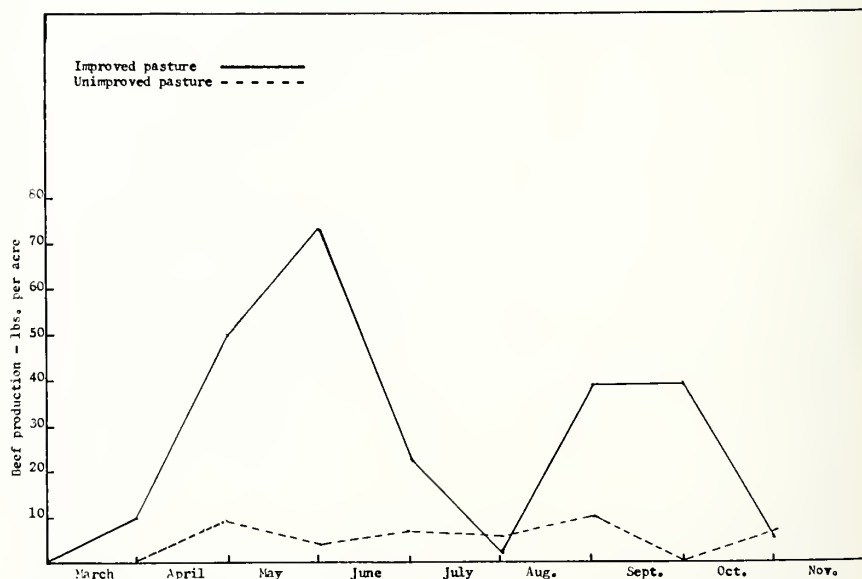


FIGURE 3.—Seasonal distribution of beef gains from pastures on Lake Charles silty clay loam at E. O. Daughenbach's farm, Lake Charles, Louisiana, 1949 - 1951.

the three years during the month of September. The seasonal distribution of grazing capacity is shown in Figure 4, and the curve follows the same general trend as the beef production per month curve.

The supplemental pastures of oats were not successful because of the poor drainage condition of the area. Only a limited amount of grazing was obtained during one year of the test. The lespedeza in the oat-lespedeza pasture produced approximately two tons of hay per acre during the first two years and 2.6 tons per acre the third year. Data on rice yields following pastures at this location were not of sufficient reliability to present. The erratic yields of rice were due to poor stands, weed and grass infestation and 2,4-D damage.

Karl Goebel Farm, Elton, Louisiana

This experiment was planted in December 1946 on Crowley silt loam at Elton, Louisiana. It included a total of 55.2 acres, with two replications of 9.2 acres of the same three treatments used in the above experiments. Grazing data in Table 1 show an average of 110 days of grazing per year for the check pastures and 196 days for the improved pastures, while the average number of animal units grazed per acre were 0.27 and 0.82 respectively. Average beef production per acre per year was 58 pounds for the check pasture and 356 pounds per acre for the improved pasture. The seasonal distribution of beef gains (Figure 5) and the

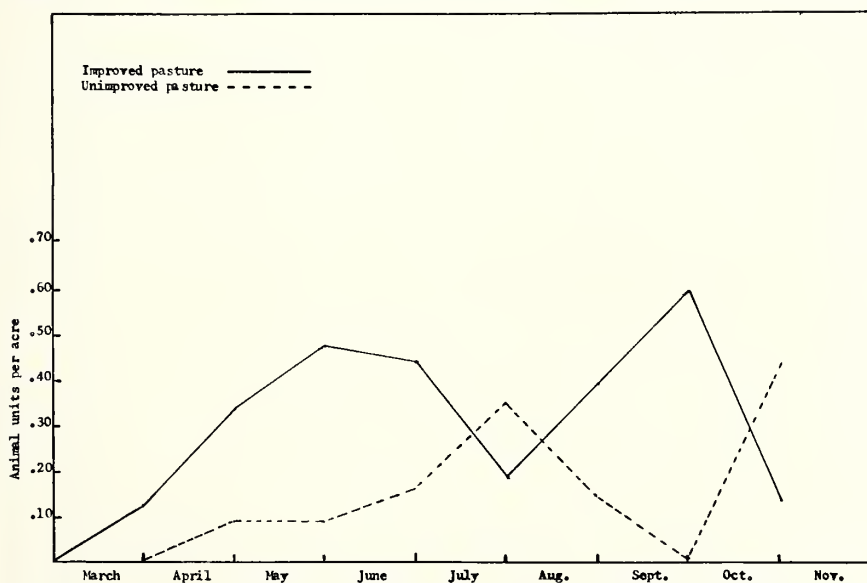


FIGURE 4.—Seasonal distribution of grazing capacity of pastures on Lake Charles silty clay loam at E. O. Daughenbach's farm, Lake Charles, Louisiana, 1949 - 1951.

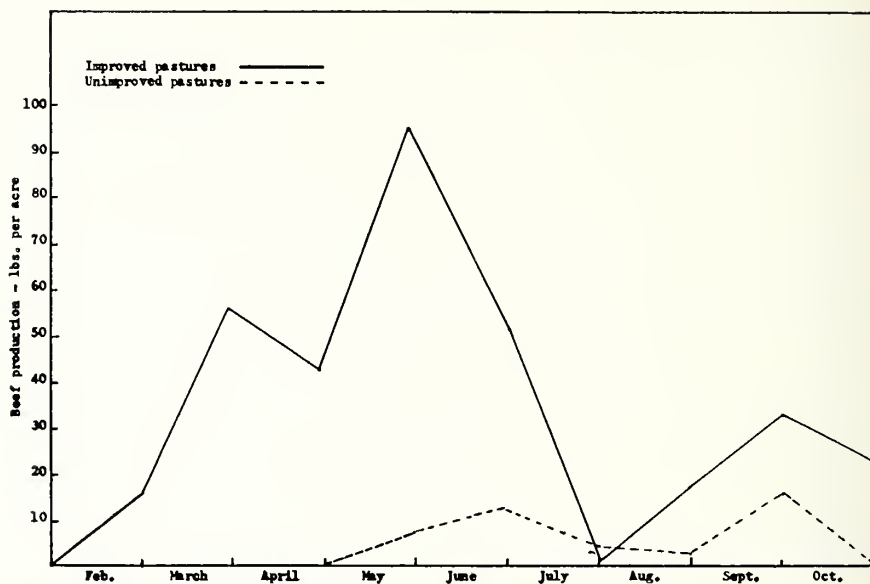


FIGURE 5.—Seasonal distribution of beef gains from pastures on Crowley silt loam at Karl Goebel's farm, Elton, Louisiana, 1947 - 1949.

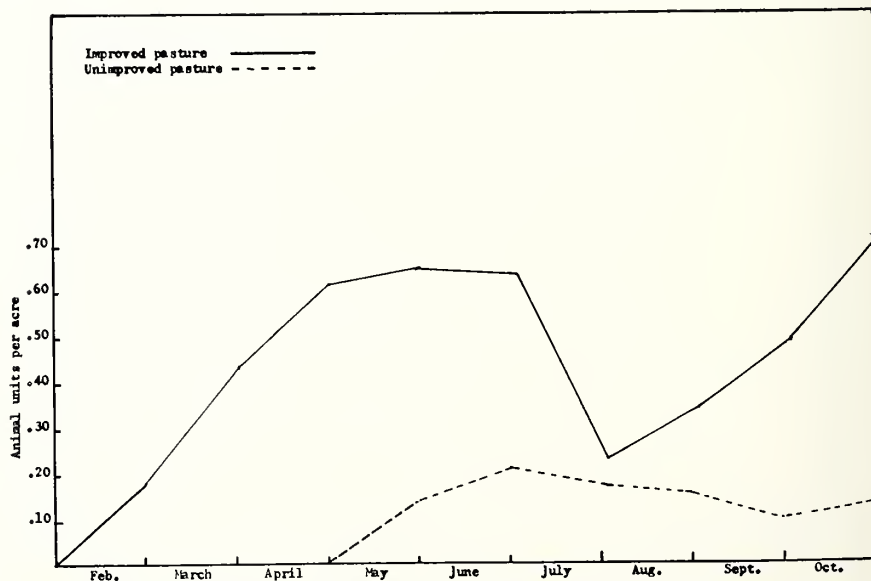


FIGURE 6.—Seasonal distribution of grazing capacity of pastures on Crowley silt loam at Karl Goebel's farm, Elton, Louisiana, 1947 - 1949.

grazing capacity per month (Figure 6) show the same general trend as in the other two experiments, except both were somewhat higher. The rice production history of this soil indicated that the general fertility level was considerably higher than that of the other experiments. This was reflected in both higher beef yields from the pastures and rice yields following the pastures.

Continuous grazing on the oat pastures could not be obtained because of the wet and muddy condition of the fields. The three-year average grain yield was 11.1 bushels per acre, and beef production on oat-lespedeza pastures was 98.7 pounds per acre per year. Hay yields of lespedeza were 0.7 tons per acre per year.

One replication of each treatment of this experiment was planted to Zenith rice in 1950 and 1951. Each pasture was divided into six plots of 1.53 acres each, three of which were fertilized with 200 pounds of 4-12-8 per acre and three were not fertilized. Rice yields in 1950 following these pastures are shown in Table 2. Rice after the improved pasture produced 25.0 barrels per acre as compared to 20.6 barrels after the check pasture. The fertilizer was more effective on rice following check pasture than on rice after the improved pasture. The increases in yield due to fertilizer were 2.4 and 1.03 barrels per acre respectively. The increase in yield due to improved pasture sod and fertilizer was 5.43 barrels per acre. These plots planted to rice in 1950 were planted again to rice in 1951 and fertilized in the same manner. Rice yields from all plots, as shown in Table 2, were considerably lower in 1951 than in 1950. The non-fertilized plots after pasture produced 15.38 barrels per acre the second year as compared to 25.0 barrels per acre for the first year following improved pastures. The increase in yield of rice from sod and fertilizer was only 2.81 barrels per acre in 1951 as compared to 5.43 barrels for 1950. The fertilizer on the rice after improved pasture plots was more effective in 1951 than in 1950. The increases due to fertilizer were 1.44 and 1.03 barrels of rice per acre for 1951 and 1950 respectively.

Joe Zaunbrecher Farm, Gueydan, Louisiana

The pastures in this experiment were planted in 1946 on Lake Charles clay loam, Gueydan, Louisiana, in a field from which 5.5 barrels of rice per acre had been harvested in the fall of 1945. The experiment included 48 acres, with three treatments replicated twice. Each replicate was 8 acres in size. Lespedeza and Dallis grass were planted on the improved pasture plots in the late spring of 1946 and white clover was planted the following fall. No grazing was obtained the first year from the spring planted pastures so the average beef yields are for two years. The average number of days of grazing per year on the check pasture was 73 and that of the improved pasture was 178. Beef production on the improved pastures averaged 184 pounds per acre per year while that of the unimproved pasture was only 36 pounds per acre.

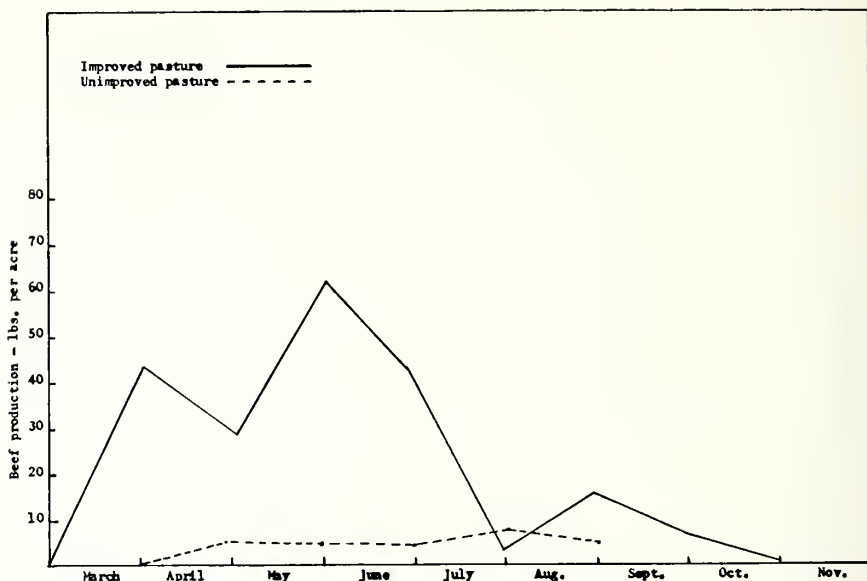


FIGURE 7.—Seasonal distribution of beef gains from pastures on Lake Charles silty clay loam at Joe Zaunbrecher farm, Gueydan, Louisiana, 1947-1948.

The seasonal distribution of beef production (Figure 7) and grazing capacity (Figure 8) on the improved pasture shows the same general trend as earlier experiments, with peak production in May and low production in July followed by moderate increase in production in August. Oat grazing in this experiment was not very successful owing to the poor drainage condition of the soil. In 1947 only 27 days of grazing were obtained by March 3, at which time the cattle were removed so that grain could be harvested. Thirteen pounds of beef and 23.7 bushels of grain per acre were produced on the oat plots and 69.7 pounds of beef per acre were produced on the lespedeza pasture. No grazing was obtained on oat plots in 1948 because of late planting; however, 28.3 bushels of grain per acre were harvested. The lespedeza produced 2.1 tons per acre.

One replication of each pasture was planted to Bluebonnet rice in 1949 and 1950. Yields are shown in Table 2. The production of rice following the improved pasture plots that received no fertilizer was 22.60 barrels per acre, while the yield following the check pasture was only 17.75 barrels per acre. The improved pasture sod and fertilizer increased rice yields 5.89 barrels per acre. In 1950, the second year in rice, yields were reduced approximately 7 barrels per acre on all plots; however, the increase in yield due to sod and fertilizer (Table 3) following the improved pasture plots was slightly higher. The fertilizer was more effective on all plots in 1950 than in 1949.

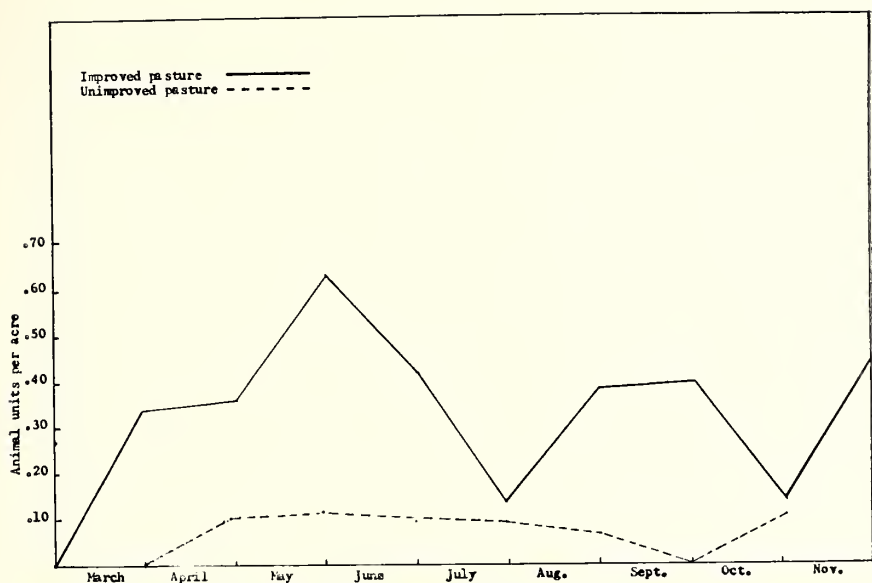


FIGURE 8.—Seasonal distribution of grazing capacity of pastures on Lake Charles silty clay loam at Joe Zaunbrecher farm, Gueydan, Louisiana, 1947 - 1948.

A. M. Moore Farm, Oberlin, Louisiana

This experiment was planted in the late spring of 1945 on Oberlin silt loam soil at Oberlin, Louisiana. The treatments were the same as used in other locations and consisted of two replications of ten acres each. No grazing was obtained the first year because of late spring planting; therefore data as presented in Table 1 are for a two-year period. The unimproved pasture produced 52 and 49 pounds of beef per acre the second and third year respectively, while on the improved pastures the yield was 367 pounds the second year and 327 pounds per acre during the third year.

Beef production on the oat plots was 60 pounds per acre for 1946 and 108 pounds per acre during 1947. No grazing was obtained on the lespedeza in 1946; however, 1.92 tons of hay per acre were harvested. In 1947 the oat plots produced 67 pounds of beef per acre and the yield of lespedeza was 0.8 ton per acre.

Rice yields following these pastures are shown in Table 2. There was little difference in the rice yields from the fertilized and non-fertilized three barrels per acre on each of the pastures. Rice yields following the improved pastures for either 1948 or 1949 (Table 3). However, the fertilizer on rice following the check pasture produced an increase of 2.30 and 0.97 barrels per acre for the first and second years respectively. Rice yields following improved pasture were 19.0 barrels per acre the first year as compared to 13.0 barrels for the unimproved pasture. The second year the yields dropped approximately

Summary

A summary of grazing data for a three-year period at each of three locations and a two-year period at two locations is presented in Table 1. No grazing was obtained the first year at two locations because of late planting, dry weather and poor stands. Under actual farm grazing conditions higher beef gains probably would be obtained from all pastures at all locations under close management. Some grazing could have been obtained from the pastures at the two locations that were not grazed during the first year of establishment, by close management. This was not possible under experimental conditions because of the cooperating farmers having to purchase desirable animals for a short period of grazing in one year and because the distance from the Experiment Station made it impossible to regulate grazing as closely as by "on the farm" management. It is also possible that the number of days of grazing

TABLE 3.—Rice yield increases due to fertilizer and fertilizer and sod following pastures at four locations

Location of Experiment	Yield increase, bbls/A, due to					
	Fertilizer* on Improved Pastures		Fertilizer on Unimproved Pastures		Sod and Fertilizer	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
Karl Goebel	1.03	1.44	1.60	0.89	5.43	2.81
Joe Zaunbrecher	1.04	1.36	0.60	1.58	5.89	6.01
A. M. Moore	0.20	-0.02	2.30	0.97	6.20	5.17
Rice Experiment Station	-0.40	0.71	2.68	2.12	6.63	0.54
Average	0.47	0.88	1.80	1.39	6.04	3.63

* Two hundred pounds of 4-12-8 per acre at all locations except Rice Experiment Station. This test received 125 pounds of 16-20-0 per acre.

could have been lengthened at all locations, as grazing was begun after a fairly good reserve was accumulated and was ended when the gains began dropping seriously in the fall. Some grazing can be obtained from improved pastures at intervals during the winter months. The average number of days of grazing on all experiments the first year was approximately two-thirds that of the second and third years. The three-year average was 130 days for the unimproved pasture as compared to 192 for the improved pasture. The average number of animal units grazed per acre was 0.30 and 0.63 for the unimproved and improved pastures respectively. Average beef production from the improved pastures was 271 pounds per acre as compared to 46 pounds per acre from the unimproved pasture.

The average seasonal distribution of gains per acre per day for all locations is presented in Figure 9. A small amount of grazing was obtained from the improved pastures in February, with production con-

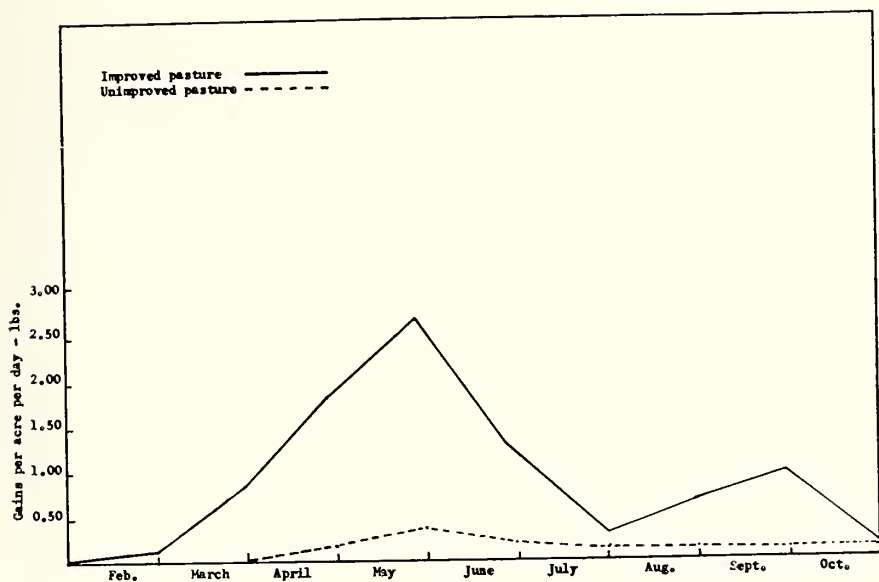


FIGURE 9.—Average seasonal distribution of beef gains from pastures at five locations, 1946 - 1952.

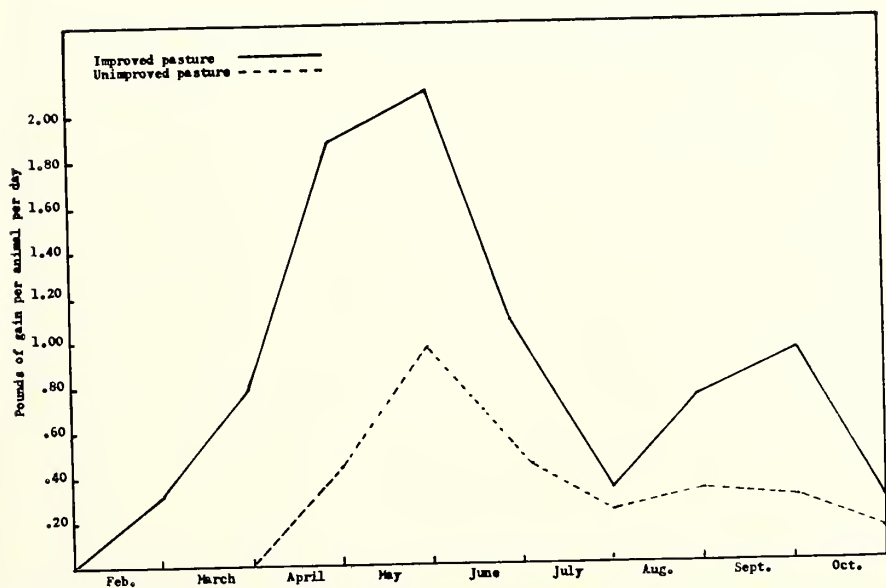


FIGURE 10.—Average seasonal distribution of gains per animal per day from pastures at five locations, 1946 - 1952.

tinuing to increase until the end of May, when it reached 2.62 pounds of beef per acre per day. This is the result of the vigorous growth of the white clover. By the end of May the clover began to disappear and dry and hot weather caused production to fall until the end of July, when a low of 0.21 pound per acre per day was produced. Production increased slightly in August and September and by the end of October practically all growth stopped.

The seasonal distribution of gains on the unimproved pasture shows the same trend as that of the improved pasture; however it was usually April 1 before any grazing could be obtained.

The pounds of gain per animal per day and the carrying capacity in animal units per acre are shown in Figures 10 and 11, respectively.

During the years in which oats were moderately grazed until February 15, beef production averaged 47.2 pounds per acre and grain yields averaged 23.9 bushels per acre. When no attempt was made to harvest grain, the grazing period was extended to approximately May 1 and the beef production was increased to 70.5 pounds per acre. The lespedeza produced an average of 1.84 tons of hay per acre when not grazed and 74.6 pounds of beef per acre when grazed. During the years when the lespedeza was moderately grazed for a portion of the season, the production was 67 pounds of beef and 0.8 ton of hay per acre.

A summary of rice yields following three years improved and non-improved pastures with and without fertilizer at four locations is shown in Table 2. The average yield the first year following improved pastures without any fertilizer applied to the rice was 22.48 barrels per acre

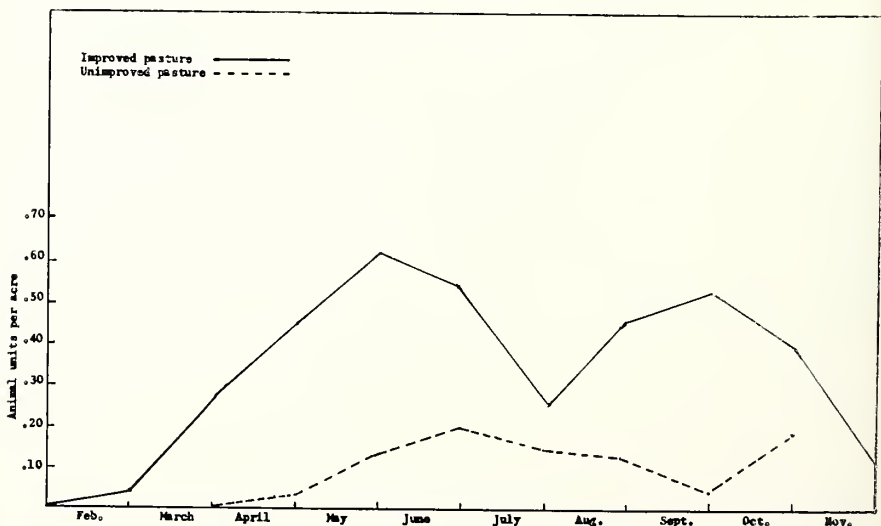


FIGURE 11.—Average seasonal distribution of grazing capacity of pastures at five locations, 1946-1952.

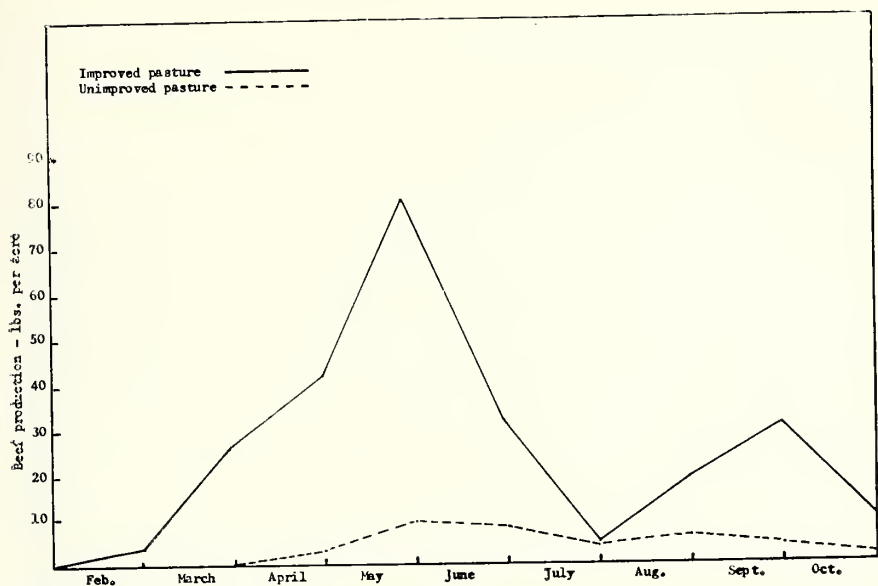


FIGURE 12.—Average seasonal distribution of gain from pastures at five locations, 1946 - 1952.

compared to 22.94 for the fertilized plots. This is an increase of only 0.46 barrel per acre. During the second year the increase in yield due to fertilizer was 0.88 barrel per acre. The average yield following the non-improved pastures with fertilizer was 18.70 barrels per acre and without fertilizer the yield was 16.90 barrels per acre. There was a reduction in yield of from 3 to 9.5 barrels per acre during the second consecutive year of rice on the improved and unimproved pastures from both the fertilized and non-fertilized plots.

A summary of rice yield increases due to fertilizer and fertilizer and sod following both the improved and unimproved pastures for the first and second year is shown in Table 3. This shows an average increase of 6.04 barrels per acre from sod and fertilizer for first year's plantings and 3.63 barrels per acre for the second year. Fertilizer on rice following the non-improved pastures increased the yield an average of 1.80 and 1.39 barrels per acre for the first and second years respectively.

DISCUSSION

The results of these five experiments tend to substantiate earlier work (2) that has been published on pasture rice rotation for southwest Louisiana.

White clover, Dallis grass, native Bermuda and lespedeza are a good pasture mixture for the rice area of Louisiana and when properly fertilized and limed, will produce good grazing from February 15 to Octo-



Oat grain crop after having been grazed until Feb. 15.

ber 15. No bloat trouble has been encountered in the use of this mixture.

An excess growth of forage occurs in April and May and a shortage of forage occurs in July and August. This poor growth in July and August is the result of dry weather. Excellent results were obtained in preventing this low production period in another pasture experiment at the Rice Experiment Station during 1954 by applying nitrogen approximately 5 inches deep with soil points followed by irrigation, as needed, to increase soil moisture to an optimum level.

The indications at present are that if improved pastures are established it is desirable to provide contour levees and irrigation during dry periods so that full benefits can be received from the relatively large investment required in establishment of good improved pastures.

The high initial cost of an improved pasture makes it necessary to obtain a minimum of three years' grazing before planting it to rice, because production in the first year is about two-thirds that of the second and third years.

Kobe lespedeza is well adapted to the rice area and is highly suitable both for summer grazing and for the production of hay, whereas common lespedeza appears to be desirable only for grazing.

Oats appear to be the most suitable crop for winter grazing; however, extreme difficulty is sometimes encountered owing to high rainfall

and poor drainage in rice soils. Good surface drainage and controlled grazing are essential if maximum yields of both beef and grain are to be obtained.

Although Atlas 66 wheat was not included in these experiments, other tests indicate that it is highly suitable for both winter grazing and feed grain production.

It is quite evident that a long-time rotation of improved pasture and rice is superior to the most common rotation of one year rice followed by one year native pasture as practiced in southwest Louisiana. More rice can be produced by using improved pasture rotations on fewer acres, and at less cost, than can be produced on the one-year-rice, one-year-pasture rotation, and these rotations, if generally adopted, would greatly expand the cattle industry in the rice area as well as improve the quality of cattle produced. The effect of this would be to promote more stability in the agricultural economy of southwest Louisiana by reducing the farmers' dependence on rice, especially during periods of surplus and low prices.

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Pastures for Profit In Southwest Louisiana

1. In planning a pasture program for maximum production of good quality beef, consider these requirements: 1 acre of improved pasture, 0.9 acre of winter pasture, 0.3 acre for hay crop and 0.2 acre for harvested grain per mature animal.
2. For improved pastures plant a mixture of Louisiana S-1 white clover, Dallis grass and lespedeza on a well-prepared seedbed that has been well fertilized and limed where necessary. These pastures may be overseeded with rye grass each fall.
3. Plant oats and wheat for winter grazing and for grain production.
4. Plant lespedeza in late February for hay production.
5. Provide small levees for irrigation as needed and insure adequate drainage, especially during the winter months.
6. Use adequate fertilizer on all pasture, grain and hay crops.
7. Practice controlled grazing.
8. Consult your County Agent or Experiment Station for further information.

Sunbonnet and Toro

NELSON E. JODON

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Sunbonnet



Toro

**2 new midseason
long-grain rice
varieties**

Bulletin No. 499

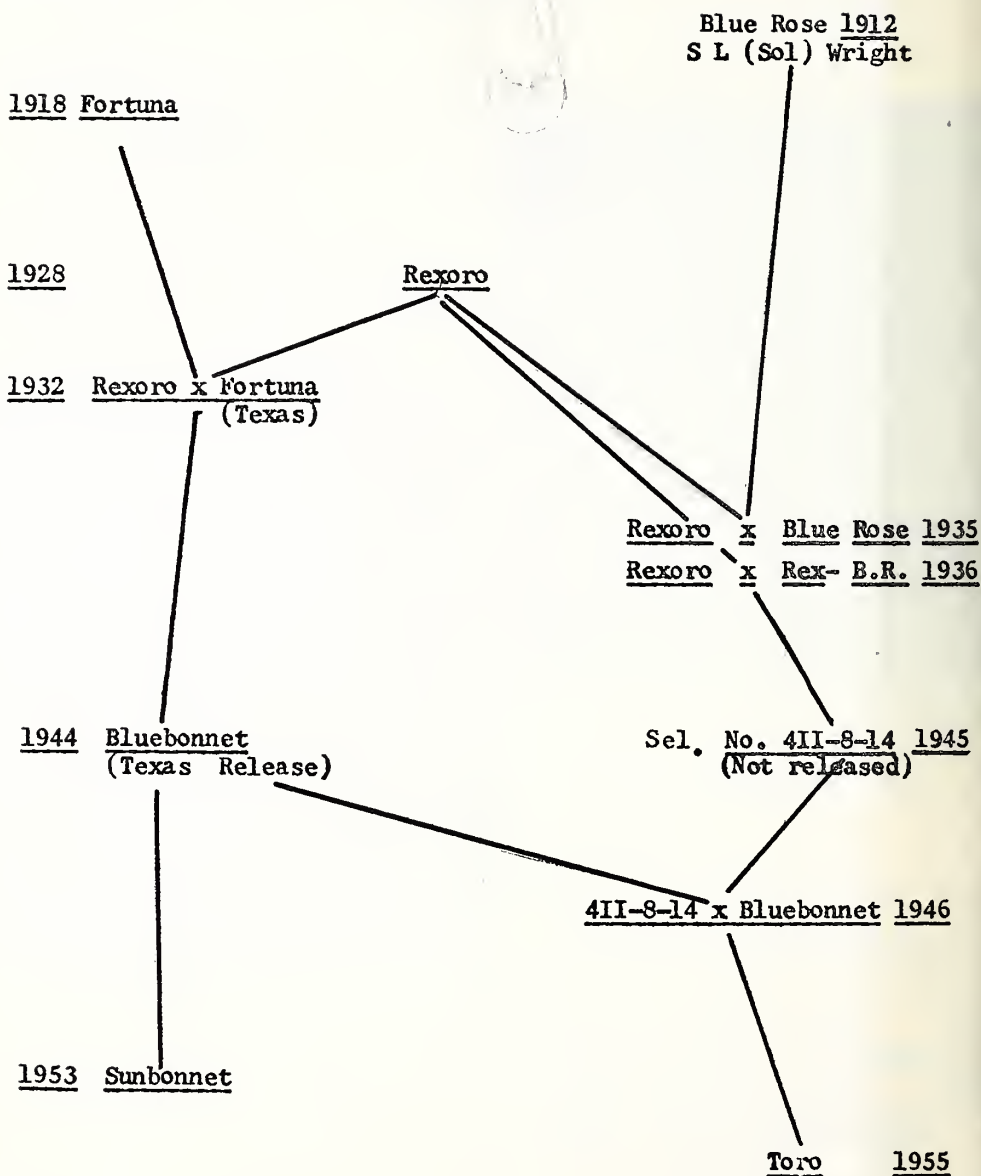
September

Louisiana State University
and
Agricultural and Mechanical College

Agricultural Experiment Station

J. N. Efferson, Director

PEDIGREE OF SUNBONNET AND TORO



Sunbonnet and Toro

Two New Midseason, Long-Grain Rice Varieties¹

NELSON E. JODON²

INTRODUCTION

Sunbonnet and Toro are productive, midseason, long-grain rice varieties with improved milling quality released in 1953 and 1955 respectively. Both of these new varieties were selected from crosses involving Fortuna and Rexoro, and Toro also has Blue Rose in its parentage. Fortuna and Rexoro were released by the Rice Experiment Station in 1918 and 1928 respectively. Blue Rose, a fairly late medium-grain variety was distributed by S. L. (Sol) Wright in 1912. Blue Rose was the leading variety in Louisiana from about 1915 to 1945, when it gave way to Zenith, which is earlier and more suitable for combining and drying. Fortuna was especially adapted to the areas of lighter soil. It was grown on a rather limited acreage before combines came into use, but by 1946 18 per cent of the state acreage was in Fortuna. However, it soon was replaced by Bluebonnet,³ a selection from a cross between Rexoro and Fortuna. Bluebonnet has shorter straw and a more slender, better milling grain than Fortuna. Rexoro also increased in importance with the advent of combining, was grown on 29 per cent of the 1946 acreage, and is still one of the leading varieties because of the excellence of its style and quality.

SUNBONNET

Sunbonnet is the progeny of one of several varieties found in the original seed-stock of Bluebonnet. It was selected from a line that was segregating straw vs. gold hull colors in 1945, and was entered in the uniform nursery in 1949 and in the field plots in 1950. An increase field of about an acre in 1951 provided the seed for growing the

¹Cooperative investigations by the Louisiana Agricultural Experiment Station and the Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture.

²Agronomist, Field Crops Research Branch, ARS, U. S. Department of Agriculture.

³Selected at the Beaumont Rice-Pasture Station, of the Texas Agricultural Experiment Station.

foundation seed in 1952 that was released under the name Sunbonnet in 1953.

The field growth of Sunbonnet is indistinguishable from that of the original Bluebonnet. The name was chosen to show the relationship. While it may be rather tall when grown on heavy land, its vigorous growth probably is desirable on average and light soils in southwestern Louisiana. It is susceptible to kernel smut, although apparently no more so than Bluebonnet where the two are grown under comparable conditions. However, in foundation fields in 1952 and 1953 and in some farm fields the degree of infection was higher than ever noted in any other variety. It is probably more susceptible to straighthead than is Bluebonnet. It has greater resistance to *Cercospora* leaf spot, and the foliage may remain fresher at maturity.

Sunbonnet threshes readily. The tip of the hull, like that of Bluebonnet, shows purple coloration but this may fade and almost disappear by harvest time. The foundation and certified seed first distributed contained a sprinkling of off-type goldhull colored grains. However, they are similar to true Sunbonnet in shape and maturity and are not objectionable to the trade.

The yield of Sunbonnet has been practically the same as that of Bluebonnet in nursery and drill-strip plot experiments.

The grain averages slightly shorter and is more uniform in length than Bluebonnet. It is usually less chalky than Bluebonnet, and because of this and of the greater uniformity in grain size, its average milling yields have been higher. Sunbonnet that matured in the exceptionally hot August of 1951, milled rather poorly but gave distinctly higher head rice indication than Bluebonnet under the same conditions.

The cooking quality of Sunbonnet is considered excellent by most consumers. It is a dry, flaky rice similar to Rexoro. While probably not equal to Rexoro for canning, it may prove fairly satisfactory for this purpose.

TORO

Toro was selected from a cross between Bluebonnet and Selection 4-II-8-14, the latter being a midseason, long-slender-grain variety from Rexoro x Blue Rose backcrossed to Roxoro. Selection 4-II-8-14 has fairly short straw and a very clear grain, but is probably less productive than Bluebonnet. Indirectly, Toro was derived from Rexoro, Fortuna, and Blue Rose, three excellent varieties that were developed by plant

introduction and varietal selection before the cross breeding program was started.

Toro was first increased in 1951 and was entered in uniform nurseries, field plots, and date-of-seeding nurseries in 1952. Although it was increased in the sixth generation after crossing, it is uniform in plant and grain type with short straw and vigorous growth.

Toro has produced good stands at all dates of seeding. It grows about four inches shorter than Sunbonnet, or about the same height as Bluebonnet 50. It is resistant to *Cercospora* leaf spot, and the foliage remains fresh and green at maturity. It may be somewhat less susceptible to kernel smut than Sunbonnet and Bluebonnet. Straighthead and stem rot have not been observed to affect it to any noticeable degree.

Toro does not thresh so readily as Bluebonnet, but can be combined satisfactorily with a properly adjusted machine. It stood up exceptionally well in the foundation seed increase field where the yield was very heavy; although exposed to wind and rain storms it went down only in a few spots. Toro apparently matures more uniformly than do the Bluebonnet varieties, which of course is desirable with combine harvesting.

The yield of Toro in test plots usually has been slightly higher than that of Bluebonnet. The yield of foundation seed following winter pasture experiments was 33.4 barrels per acre, compared to 31.4 barrels from Zenith, showing that it has the capacity to produce high yields under conditions of high fertility.

The grain is essentially the same size and shape as that of Sunbonnet, but may be distinguished by the colorless tip of the mature grain. The kernels are mostly crystal clear, only a very few showing any chalkiness, thus resulting in an exceptionally high head rice turn-out in milling.

The cooked rice is less flaky than that of Bluebonnet, but is not objectionably sticky. It may be described as firmer and more moist.

HISTORY OF SUNBONNET (C. I. 8989)

A selection from Bluebonnet (C. I. 8322)

- 1940-43 Sel. No. B322A4-2-3-1 (Bluebonnet), from H. M. Beachell, Rice-Pasture Experiment Station, Beaumont, Texas, was grown in uniform nursery.
- 1944 Bluebonnet was grown as a check (row No. 760) in the progeny row nursery. This was probably sown with bulk seed from 1943 No. 225 and not a plant selection.
- 1945 Sixty panicle selections from 1944 row 760 were grown in rows for the purpose of repurifying the seed stock on plot No. 8058.
- 1946 One of the selections from 1945 plot 8058 was sown in progeny row No. 1784. It was segregating for straw vs. goldhull color, as were 4 out of 6 strawhull lines from a segregating row in 1945 plot 8058. This row was selected as having shorter straw.
- 1947 Progeny row No. 1666. Strawhull color, but next to another selection from 1946 row 1784 that was segregating for straw vs. goldhull.
- 1948 Entered in Row Block Increase, No. 4090. Best appearing milled sample among several Bluebonnet selections. (Plot 4090 was adjoined by a goldhull selection from Bluebonnet.)
- 1949 Entered in uniform nursery for first time. Increased in row blocks, No. 4094 & 4095. Noted as being *Cercospora* resistant, uniform in height, and as giving a better milled sample than Bluebonnet. (Plot 4095 was adjoined by a goldhull selection from Bluebonnet.)
- 1950 Entered in field plot tests for first time (Variety 41). Less *Cercospora* observed than in Bluebonnet.
- 1951 One increase field of about $\frac{3}{4}$ acre was grown from 1950 V 41, producing about 17 barrels of seed. It was partly lodged, although not so badly as some other varieties, owing to wind and rain before it could be thoroughly rogued. A milling test on samples from the drilled plots showed 33 per cent head rice for Sunbonnet and 17 per cent for Bluebonnet.
- 1952 Two increase fields totaling about 25 acres were grown, and about 200 barrels of recleaned seed were available for distribution. A considerable number of goldhull plants were present in the increase fields, and many of these were missed in rogueing. The grain type of these off-color plants is very similar to the true type, however, and the trade does not object to the presence of some grains with gold-colored hulls. There were probably 3 to 5 of these per pound after cleaning.
- In addition to the milling data shown in the preceding table, an unofficial test made on samples from the Stuttgart Uniform Nursery gave about 49 per cent head rice for Sunbonnet and about 11 per cent for Bluebonnet.
- 1953 Released as a new variety and foundation seed distributed. The name was chosen to indicate the relationship to Bluebonnet and to distinguish it from the other Bluebonnet varieties being grown.

PEDIGREE OF TORO (C. I. 9013)

A selection from 4-II-8-14 x Bluebonnet (1946 Cross 711)
released to growers in 1955

- 1907-11 Off types were found in Japanese rice by F. F. Shoemaker, and from these S. L. Wright selected Blue Rose.
- 1912 Blue Rose (C. I. 1962) first grown commercially.
- 1918 Fortuna (C. I. 1344), selected by Charles E. Chambliss & J. M. Jenkins from an introduction from Formosa, was released by the Rice Experiment Station.
- 1928 Rexoro (C. I. 1779), selected by Charles E. Chambliss & J. M. Jenkins from an introduction from the Philippines, was released by the Rice Experiment Station.
- 1932 The cross *Rexoro* x *Fortuna* was made by H. M. Beachell at the Rice-Pasture Experiment Station, Beaumont, Texas.
- 1936 A backcross of *Rexoro* x *Blue Rose* to *Rexoro* was made by the writer at the Rice Experiment Station.
- 1944 Bluebonnet (C. I. 8322) released by Rice-Pasture Experiment Station.
- 1946 Selection 4-II-8-14 from the backcross *Rexoro* and *Blue Rose* combination made in 1936 (which matured ahead of *Fortuna* and had a *Rexoro* type grain) was crossed with *Bluebonnet*. 1946 Cross Number 711.
- 1947 F_1 plants of the Cross 4-II-8-14 x *Bluebonnet*, were grown in plot number 5034-3.
- 1948 F_2 population was grown in plot number 6068.
- 1949 F_3 plant selection was grown in row number 1936.
- 1950 F_4 plant selection grown in row number 2198 was a productive appearing, short-straw strain.
- 1951 F_5 plant rows grown in a block (4020) to check uniformity, growth characteristics, and grain quality.
- 1952 F_6 plant rows grown in a block, Number 4105. Entered in field plot (V36) where it gave same yield as *Bluebonnet*. It was also entered in Uniform Nurseries and in Date-of-Seeding Nurseries.
- 1953 F_7 seed from the 1952 row-block was used to seed a one-acre increase. Field plot and nursery tests were continued. These showed the selection to have short strong straw, good yielding ability, and exceptionally high milling quality.
- 1954 A foundation seed field of 20 acres was seeded from the one-acre increase of 1953. Field and nursery tests were continued. Named "Toro" because (1) "oro" indicates the *Rexoro* inheritance received from both parents, (2) the Spanish word Toro (meaning bull) characterizes its sturdy plant and hard grain type.
- 1955 About 400 barrels of foundation seed made available to growers for the production of certified seed of Toro.

RESULTS FROM TESTS 1952-1954

Three-year average results from uniform nursery tests at three stations are shown in Table 1. Data from the Arkansas station are available as a result of cooperative USDA Arkansas Agricultural Experiment Station Rice Breeding Project, Stuttgart, Arkansas, by courtesy of Dr. T. H. Johnson. Data from the corresponding project at the Beaumont Rice-Pasture Station of the Texas Agricultural Experiment Station are similarly available by courtesy of Mr. H. M. Beachell.

TABLE 1.—Average maturity, height, yield, and milling yield of Toro, Bluebonnet 50, Bluebonnet, Sunbonnet, and Improved Bluebonnet in Uniform Nursery Tests, 1952-1954, at Stuttgart, Ark., Crowley, La., and Beaumont, Texas

Variety	Days Seeding to Maturity	Height (inches)	Yield per Acre (Lbs.)	Milling Yield % Head-Total
<i>Arkansas</i>				
Toro	148	45	3560	58-71
Bluebonnet 50	148	46	2880	50-71
Bluebonnet	148	49	3281	40-70
Sunbonnet	147	52	3362	54-71
Improved Bluebonnet	152	46	3335	49-70
<i>Louisiana</i>				
Toro	137	44	2925	58-69
Bluebonnet 50	138	44	2688	48-69
Bluebonnet	138	47	2782	49-70
Sunbonnet	140	46	2508	50-70
Improved Bluebonnet	144	46	2735	45-68
<i>Texas</i>				
Toro	140	47	3319	60-69
Bluebonnet 50	139	48	3324	50-68
Bluebonnet	139	54	3305	43-70
Sunbonnet	139	53	3316	49-71
Improved Bluebonnet	143	50	3692	53-68

Five varieties are included for comparison: Toro, Bluebonnet 50, Bluebonnet, Sunbonnet, and Improved Bluebonnet. Bluebonnet 50 is a short-straw re-selection from Bluebonnet which was released in Texas in 1951. Improved Bluebonnet is a selection from Rexoro x Nira, and was released in Texas in 1947.

In these tests Toro matured at the same time as Bluebonnet 50 and had slightly shorter straw. Toro gave the highest average yield in Arkansas and Louisiana, but in Texas it averaged below Improved Bluebonnet. Toro was one of three long-grain varieties yielding 20 barrels per acre at the Everglades Experiment Station, Belle Glade, Florida, according to Dr. V. E. Green, Jr. The head rice turn-out of Toro was distinctly high at all stations, Sunbonnet being next best.

TABLE 2.—Maturity, height, yield, and milling quality of Toro, Bluebonnet 50, Sunbonnet, Bluebonnet, and a Bluebonnet selection grown in quadruplicated drill-strip plots at the Rice Experiment Station, Crowley, La., 1952-54

	Year	Toro	Blue- bonnet 50	Sun- bonnet	Blue- bonnet	Blue- bonnet Sel.
DAYS SEEDING TO MATURITY	1952	140	143	143	143	143
	1953	140	140	140	140	140
	1954	145	147	147	147	145
	AVERAGE	142	143	143	143	143
HEIGHT (Inches)	1952	41	46	48	50	48
	1953	48	50	51	53	49
	1954	54	54	58	58	58
	AVERAGE	48	50	52	54	52
YIELD PER ACRE, LBS.	1952	2596	2389	2244	2616	2420
	1953	3570	2830	3132	2806	3021
	1954	3880	2989	3116	3085	3625
	AVERAGE	3349	2736	2831	2836	3022
MILLING YIELD, % HEAD & TOTAL	1952	..	..	..	..	..
	1953	65-69	48-69	60-70	53-71	54-70
	1954	57-67	50-67	56-68	57-68	40-67
	AVERAGE	61-68	49-68	58-69	55-70	47-69

Results from the replicated drill-strip experiments at the Rice Experiment Station are shown in Table 2. Data for the individual years are given in this table.

Five varieties are included in this comparison also, but an un-named Bluebonnet selection replaced Improved Bluebonnet. This selection was made at the same time as Sunbonnet and has a more slender grain, but does not mill so well and is not being released.

In these tests Toro matured at essentially the same time as the other varieties, had slightly shorter straw than Bluebonnet 50, and gave the highest average yield. It was exceeded in yield only in 1952 when Bluebonnet outyielded it by a mere 20 pounds per acre. Milling results were obtained only for 1953 and 1954, but indicate superior milling quality for Toro and Sunbonnet.

Toro, Bluebonnet 50, and Sunbonnet were included in a date-of-seeding experiment. The results are shown in Table 3. There were 11 tests in the three years 1952-1954. These three midseason, long-grain varieties which were compared in the date-of-seeding tests matured at the same time, but the length of the growing period ranged from 191 days for the February seeding to 136 days for the May seeding. Toro averaged one inch shorter than Bluebonnet 50 and three inches shorter than Sunbonnet. It yielded more than Bluebonnet 50 and Sunbon-

TABLE 3.—Maturity, plant height, grain yield, and milling quality of Toro, Bluebonnet 50, and Sunbonnet grown in a date-of-seeding experiment at the Rice Experiment Station, Crowley, Louisiana, 1952-54

Seeding Date	Seeding ¹ to Heading (Days)	Plant Height			Grain Yield, Per Acre			Milling Yield, Head—Total		
		Toro (In.)	Blue-bonnet 50 (In.)	Sun-bonnet 50 (In.)	Toro (LBS.)	Blue-bonnet 50 (LBS.)	Sun-bonnet (LBS.)	Toro (%)	Blue-bonnet 50 (%)	Sun-bonnet (%)
2-8-54	191	39	42	42	1949	1891	1619	60-68	37-38	48-69
3-25-52	153	46	46	51	2986	3098	3501	60-69	48-68	49-67
3-6-53	157	47	50	51	2626	2509	2613	55-72	36-71	33-73
3-12-54	159	41	43	45	2624	2446	2365	60-68	45-67	48-69
Mean 3-14	156	45	46	49	2745	2684	2826	58-70	43-69	43-70
4-16-53	146	48	49	48	3717	2870	2676	66-72	52-71	57-73
5-9-52	139	47	49	51	2945	3198	3270	64-70	52-70	66-71
5-26-53	139	48	46	49	2586	1733	1731	68-71	64-72	67-73
5-7-54	131	41	45	45	2091	2209	2062	61-68	54-68	56-68
Mean 5-14	136	45	47	48	2541	2380	2388	64-70	57-70	63-71
6-11-52	138	43	45	48	2942	2674	2820	60-70	51-71	56-61
6-16-53	133	42	44	44	1942	1697	1154	67-72	64-74	64-74
6-28-54	141	48	49	51	2809	2815	1927	47-68	46-68	45-66
Mean 6-18	137	44	46	48	2564	2395	1967	58-70	54-70	55-67
Mean all tests	...	45	46	48	2656	2467	2340	61-70	50-70	54-69

¹Same maturity for all varieties.

net in 7 of the 11 tests, but was exceeded by Sunbonnet in 2 tests and by Bluebonnet 50 in 4 tests. Toro produced distinctly higher percentages of head rice on the average than the other varieties.

[For a comparison of Sunbonnet and Toro, see the back cover page.]

Two New Varieties Compared

SUNBONNET

TORO

—ORIGIN—

Reselection from
Bluebonnet (a Rexoro x
Fortuna Cross)

From crosses involving
Rexoro, Blue Rose &
Bluebonnet

—RELEASED—

1953

1955

—ADAPTED FOR SEEDING—

March to June

March to June

—DISEASE—

Susceptible to
straighthead & kernel
smut

Seems fairly resistant
to all important
diseases

—PLANT HEIGHT—

Same as Bluebonnet

No taller than Bluebonnet 50

—STRAW STRENGTH—

Stands well

Stands up exceptionally well

—THRESHING—

Easy

About like Zenith

—YIELD—

Same as Bluebonnet

Slightly higher than
Bluebonnet

—HULL COLOR—

Straw color,
purple tip (may fade)

Straw color,
colorless tip

—GRAIN TYPE—

Similar to Bluebonnet,
more uniform, less chalky

Similar to Bluebonnet,
very clear

—MILLING—

Usually better than
Bluebonnet

Exceptionally high

—COOKING—

Flaky, "dry," like
Bluebonnet

"Firmer, "moist," good
flavor

Daffodils for the Yard

By

W. D. KIMBROUGH AND R. H. HANCHEY

O.K. FOR REVIEW.....

REVIEWED IN MAR 1956



The Alasnam

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LOUISIANA STATE UNIVERSITY
and
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
J. N. Efferson, Director

Daffodils for the Yard

W. D. Kimbrough and R. H. Hanchey

INTRODUCTION

The aim of many home gardeners in the Deep South is to have flowers in bloom as nearly the year around as possible. The least effort it takes to do this, the more likely it is to be done. Flowers from bulbs that can be grown successfully in an area are in general easy to grow. One of the most popular of these is the *Narcissus* group. Types and varieties that are adapted are very satisfactory and produce an abundance of flowers with relatively little effort. They start blooming very early in the year, and blooms can be had for a period of about eight weeks with a period of about four weeks when many different excellent varieties can be had. Colors vary from so-called white to dark yellow with pink tints in some varieties. They bloom at the time of the year when other flowers are not plentiful and for this reason are especially important. They make excellent long-lasting cut flowers or may be used to add color to the landscape. They should be in all yards where flowers are considered of importance. The cost of bulbs will vary with the variety. The older, more easily increased types are cheaper. Recent introductions are generally expensive and it is usually the daffodil fancier that is willing to pay the price for very new ones. Daffodil bulbs can not be considered especially cheap, though the better established kinds should not be unreasonably high. In general it is best to buy good bulbs from reliable firms.

NOMENCLATURE

The nomenclature regarding the plants of the genus *Narcissus* is somewhat confused. All are really narcissus but popular usage has divided them into at least three groups—narcissus, jonquils, and daffodils. The variety Paper White is an example of the narcissus, the jonquils have round leaves similar to some onions, and the daffodils include a wide variety of types ranging from the long trumpets to the clustered Poetaz kinds. In this bulletin the above grouping of narcissus, jonquils, and daffodils will be used. Hybrids between different types tend to make any grouping more complicated.

ACKNOWLEDGMENT—Appreciation is expressed to Mr. Jan DeGraaff of the Oregon Bulb Farms and to Dr. J. M. Jenkins, Jr., Horticulturist in Charge, Vegetable Research Laboratory, Wilmington, N. C., for contributing some of the bulbs used in the variety trials.

NARCISSUS

This group consists of *Narcissus tazetta* which originated in southern Europe and is not as hardy as daffodils or jonquils. It is hardy and easily grown in Louisiana. There should be no difficulty in growing the Paper White or the Pearl White Lily (called Creole narcissus in south Louisiana.) Both seem to be immune to the basal rot organism. The Paper White is earlier, often blooming in early January in south Louisiana, but does not produce as large flowers or bulbs as the Creole. Both have a very strong fragrance, and some people are allergic to them. The yellow Soleil d'Or belongs to this group, but it is not as successfully grown as the other two varieties mentioned. The Chinese Sacred Lily also belongs to this group. The main difficulty likely to be encountered in growing the Paper White and Creole varieties is that when they are left in place for several years they may become so crowded that very poor blooms, if any, are produced. They should be dug and separated before this is allowed to happen. If they are grown in insufficient light they can not be expected to produce good flowers.

JONQUILS

Most of the commonly grown jonquils are fairly easy to grow. They are usually early and produce yellow flowers of various sizes, and the number of flowers per bloom stalk varies. They are hardy but not as vigorous as narcissus. They are apparently resistant to diseases causing rot, and a planting should last for many years. They are not likely to become crowded as easily as narcissus.

DAFFODILS

This is the most important group of the *Narcissus* genus. Classification in this group is not generally agreed upon. It is this group that has the most fanciers. Shapes, sizes, colors, and time of blooming are quite variable. Plants in this group are hardy and extensively grown. Breeders continue to introduce new varieties. One of the main reasons why daffodils are not more generally grown in Louisiana, especially in the southern part of the state, is that difficulty has been encountered in growing many varieties. This is especially true with the varieties in the long-trumpet group.

Because of the interest in daffodils and the lack of reliable information concerning them in this area, it was believed that some experimental work should be done with them. This has been done for six years now. Recommendations in this bulletin are based on results obtained here, those of other investigators, and from observations and experience.

CLASSIFICATION

There is not complete agreement concerning the classification of *Narcissus*. The following system is believed to be one of the best.

Division 1

Trumpet Narcissus—One flower to a stem; the trumpet or corona as long or longer than the perianth segments; solid colors, bicolors or tinted. King Alfred, Mrs. E. H. Krelage, Queen of the Bicolors, etc.

Division 2

Large-cupped Narcissus—One flower to a stem; cup or corona more than one-third, but less than equal to, the length of the perianth segments; solid colors, bicolors, or tinted. Fortune, Have-lock, Tunis, etc.

Division 3

Small-cupped Narcissus—One flower to a stem; cup or corona not more than one-third the length of the perianth segments; solid colors, bicolors, or tinted. John Evelyn, Brookville, Dick Wellband, etc.*

Division 4

Double Narcissus—Twink, Irene Copeland, Texas, etc.

Division 5

Triandrus Hybrids—Thalia, Silver Chimes, Moonshine, etc.

Division 6

Cyclamineus Hybrids—February Gold, Beryl, Jenny, etc.

Division 7

Jonquilla Hybrids—Golden Sceptre, Trevithian, Golden Perfection, etc.

Division 8

Poetaz Narcissus—Laurens Koster, Geranium, Cheerfulness, etc.

Division 9

Poeticus Narcissus—Actaea, Red Rim, Dactyl, etc.

VARIETY TEST

One of the most important considerations in growing any crop is to plant varieties that are suitable to the area in which they are to be grown. For this reason variety trials have been run. In the fall of 1949 a number of varieties of daffodils were obtained from Holland, and several varieties were sent for trial from the Wilming-

*These varieties are often put in the large-cupped division and varieties such as Diana Kasner, Nettie O'Melveny, and Roman Star are put in the small-cupped division.

ton Experiment Station in North Carolina. The following year some bulbs were obtained from commercial sources in North Carolina and the Pacific Northwest and from a well-known distributing company in the Middle West. The following year small lots of a number of varieties were sent here for trial from a large commercial bulb farm in Oregon, and larger lots of varieties that had seemed promising were purchased from the same source. Some bulbs were obtained from the same source the following two years. Good bulbs were received from all sources, though good results were not necessarily obtained in all instances.

The varieties that have been tested to date are as follows:

Actaea	Erna Rubenstein	Lucienne
Ada Finch	Eskimo	Mekkada
Adventure	February Gold	Moonshine
Aerolite	Firetail	Moulin Rouge
Agra	Fortune	Mount Hood
Alasnam	Geranium	Mrs. E. H. Krelage
Alcida	Gertie Millar	Mrs. R. O. Backhouse
Beats All	Glory of Sassenheim	Nettie O'Melveny
Beersheba	Golden Harvest	Norway
Ben Hur	Golden Pedestal	Nova Scotia
Brookville	Golden Perfection	Odorus Plenus
Burgemeister	Golden Sceptre	Odorus Regulosus
Gouverneur	Green Emerald	Oliver Cromwell
Carbineer	Havelock	Old Pheasant Eye
Carlton	Helios	Pirates Gold
Carveth	Holland Glory	Pres. Le Brun
Cheerfulness	Indian Chief	Prominent
China Clay	Insulinde	Queen of the Bicolors
Crever	Insurpassable	Quicksilver
Crocus	Irene Bordini	Rapture
Daisy Schaffer	Irene Copeland	Red Bird
Damson	John Evelyn	Red Guard
Daphne	King Alfred	Red Rim
Dawson City	Lady Diana Manners	Rembrandt
Delaware	Lady Kesteven	Rene de Chalons
Dick Wellband	Lanarth	Rewa
Diotima	Lauren's Koster	Roman Star
Duke of Windsor	La Vestal	Roxane
Duncan	Le Mogul	Royal Sovereign
Early Perfection	Leviathan	Sarchedon
Eclair	Lorelrus	Scarlet Elegance
E. H. Wilson	Lovenest	Shot Silk

Sir Watkins	Sweet Melody	Twink
Silver Chimes	Texas	Victoria
Silver Star	Thalia	Warwick
Spring Glory	The First	White Nile
St. Agnes	Therapia	Whitley Gem
St. Egwin	Trevithian	Wintergold
Successor	Triandrus Albus	Winter Pride
Suda	Tunis	Yellow Cloud
		Yellow Poppy

RECOMMENDED VARIETIES

These are the varieties that have done best in the test plots to date:

Fortune—This has been the best variety of the large-cupped type that has been grown. When left in place for three years the size has held up very well and loss of bulbs has been slight. It is believed to be one of the best varieties of daffodils to plant.

Helios—Another of the large-cupped type that has done very well in the experimental plots. When left in place for three years the size of flowers deteriorated considerably. There was very little loss in bulbs.

Havelock—Another one of the better varieties of the large-cupped type.

Alasnam—The flowers of this variety of the long-trumpet type are not as fine as those of the King Alfred variety but it has been much more dependable here. It is well worth trying.

Brookville—This variety is a member of a group of varieties that are similar in type to John Evelyn. The blooms are believed to be better than John Evelyn and it is a much more reliable variety. This is considered to be an excellent addition to the varieties that can be highly recommended for planting. It is well worth a trial. The main difficulty will be in finding bulbs to plant.

Lucienne—This is another good variety that is somewhat similar to Brookville but is a little earlier. It is recommended for planting. The main difficulty with this variety will likely be in locating bulbs to plant.

St. Egwin—Another of the flat type daffodils that has done well in the experimental plots.

Carbineer—One of the flat type that has grown very well but the blooms are only medium in size.

Thalia—This has been found to be the outstanding variety in the Triandrus hybrid group. From one to four delicate white flowers are produced per flower stalk. It is a very beautiful, reliable variety that will produce blooms year after year. This variety is highly recommended for planting.

Silver Chimes—Another of the Triandrus hybrids that has been outstanding in the test plots. It is a little later blooming than Thalia and produces a number of smaller flowers per flower stalk.

Golden Sceptre—Most of the Jonquilla hybrids that have been tested have grown satisfactorily. This variety is one of the better ones.

Lanarth and Trevithian are two other varieties of this type that are worthy of trial.

Twink—If a double variety is desired this is a very good one.

Laurens Koster—If one of the Poetaz daffodils is desired this is a good one to try. A number of flowers are produced per flower stalk but they are somewhat smaller than several others in this group.

OTHER VARIETIES THAT MAY BE WORTH TRYING

The following varieties have done very well in plots so far. They are recommended with reservations.

Tunis—Very large, strikingly beautiful, large-cupped type blooms are produced. One of the most showy varieties. Stands have not held up too well, but in spite of that it is believed to be worthy of trial.

Carlton—Another excellent large-cupped variety, the stands of which have not held too well.

King Alfred—This variety can not be left out entirely. The results with it have been variable. In some cases it has done as well as any variety can be expected to do when left in place for three years. In others at the end of three years very few bulbs have been left. This seems to be due to damage from basal rot. One lot of King Alfred bulbs was so badly infested with basal rot that very few blooms were produced the first year. In yards in this area it has been observed that where bulbs have not rotted, plants have been erratic insofar as blooming is concerned. This variety will often be found to be satisfactory. It is a large-trumpet variety.



ALASNAM



HAVELOCK



BROOKVILLE



KING ALFRED



FORTUNE



MRS. E. H. KRELAGE



SILVER CHIMES



TREVITHIAN



ST. EGWIN



TUNIS



THALIA



TWINK

Mrs. E. H. Krelage—This so-called white-trumpet variety is one that has been frequently found to be satisfactory in yards. It is generally considered to be one of the better varieties to plant. Flower stalks of this variety have been found to have blind buds the first blooming season after the bulbs were obtained, but bloomed normally in subsequent years. No explanation is offered for this behavior. In the experimental plots the behavior of plants of this variety has not been very good.

Mrs. R. O. Backhouse—There are several pink daffodils at the present time, but this was the first important one of this type. It belongs to the trumpet group. Bulbs that were obtained of this variety have not been too solid, nor did they appear in too good condition. Not too much was expected from them. However, in general, results have been fairly good. Plants have not been very vigorous and the blooms not too large. In spite of being a fairly late variety it has held up very well.

Ada Finch—This white-trumpet variety has produced outstandingly beautiful blooms. The only trouble is that the stands have not held up too well. In spite of that it seems worthy of trial.

Gertie Millar—This white-trumpet variety has done very well in the trials. There is a tendency for flower stalks to be short.

Lovenest—Another of the pink daffodil group that has done very well. Plants are not too vigorous and the blooms are not large.

Dick Wellband—In spite of being a late variety this flat type daffodil has done very well.

Of course there are many varieties that have not been tested to date and some of these are no doubt good ones. Of the many varieties tested relatively few can be recommended. Early and medium early varieties have been found in general most satisfactory. Some range in blooming time, however, is desirable in order to have flowers over a longer period of time. Resistance to basal rot is of extreme importance in many areas. Plant breeders will continue to introduce new varieties. If local information concerning adaptability to a given area can be obtained, it should be given consideration. There are two yellow-trumpet daffodil varieties that should be mentioned. They produce very large yellow-trumpet blooms. They are Golden Harvest and Diotima and should be excellent in areas where basal rot is not a problem. Both are very susceptible to basal rot.

CULTURAL PRACTICES

In general good bulbs should produce flowers the first season that they are obtained, because the bloom buds have already been formed when they are bought. This means that the flowers produced the first year are largely determined by the bulbs obtained and are not affected too much by cultural conditions, short of injury. All bulbs, however, do not flower as they should even the first year. Five hundred bulbs of the Beersheba variety were obtained and planted one year and not one bloom was obtained the first year and very few the second year. Excellent blooms were obtained from nearly all of the bulbs of many other varieties from the same source when all were handled similarly. Even the vegetative growth of the Beersheba plants was not vigorous and most of the bulbs were lost before the next blooming season. The ones that did live produced flowers but they were not good ones for the variety. It is a late variety, and that may be a partial explanation as to why better results were not obtained. Late varieties may not bloom until the weather is so warm that they do not do well, but they usually do produce blooms the first year.

One of the main reasons why bulbs of some varieties do not produce blooms the first year is that they are very susceptible to basal rot, which is caused by a fusarium which rots the bulbs before there is time for flower production. Some apparently healthy bulbs obtained for experimental use from reliable sources have been so infested with basal rot that few if any flowers were obtained the first year because the bulbs rotted.

Sometimes good plant growth will be obtained but flower stems will be blind. This means that the bloom stalks will appear, but the buds will dry up and no flowers will open. This is usually caused by some environmental factor, but there may be a varietal susceptibility to this condition.

Even though good flowers may be obtained the first year after buying bulbs, it is very desirable to have varieties that will produce blooms year after year. Not many people could afford or would be willing to buy new bulbs every year. Even when dependable varieties are grown under our conditions it is usual for the bulbs to get smaller and the blooms to decrease in size as the years pass until there is a tendency for a general leveling off in size. If the bulbs are left in place they will normally increase in number and become very crowded. This will tend to reduce the size of bulbs and flowers.

The bulb is a storage organ, and the amount of material stored

and size of the bulb are dependent on the foliage and seasonal conditions. The leaves make the food that largely determines the size of the bulb for the next year. This means that good foliage growth is necessary. Good foliage alone, however, does not insure good bulbs. The rate of respiration in the plant increases with rise in temperature up to an optimum level, and that means that at high temperatures there may be little if any excess food made that can be stored. This is the probable explanation as to why late varieties are in general unsatisfactory in this area.

Some recently reported work indicated that cutting blooms may have some effect on the size of bulb produced. This is because the stem is green and can synthesize food. Daffodils that are grown for cut flowers should be cut even though bulb size is slightly reduced, but for bulb production flowers should not be cut. Seed should not be allowed to form unless there is an interest in growing seedling plants. Sometimes when flowers are cut, some leaves are also cut to add some green to the bouquet. This is definitely injurious to the plant. If leaves must be cut it is recommended that a few plants of some vigorous kinds be grown especially for that purpose.

A certain amount of light is necessary for leaves to function properly in the manufacture of food. If light is insufficient, good results should not be expected.

PLANTING

Bulbs should be ordered well in advance of time for planting to help insure obtaining what is wanted. The bulbs should be planted in October if possible, but delivery may not be made until November even when orders have been sent in much earlier. Bulbs should be planted as soon as possible after they are received. Do not plant when the soil is muddy. Good soil drainage is essential if daffodils are to be grown successfully. The soil should be thoroughly prepared to a depth of about twelve inches. Loamy soils are best, but daffodils can be grown in a wide range of soil types. It would be well to mix some sand into heavy clay soil. Well decomposed manure or other organic matter worked into the soil should be beneficial in improving soil texture. Large bulbs should not be planted closer than six inches apart if they are to be left in place for more than one year. If bulbs are set out in rows, double rows may be planted and the space better utilized, if they are spaced so as not to be opposite each other in the row. If bulbs are to be

dug and replanted every year they may be planted closer together than when they are to be left in place.

Bulbs should be covered with two to five inches of soil above the top of the bulb depending on the size of bulb and the soil texture. The larger bulbs should be planted deeper, and on sandy soils deeper planting may be practiced than on heavier soils. If bulbs are planted on ridged rows, the ridges are likely to wash down and the depth of covering become less. Bulbs planted too near the soil surface may be affected by temperature changes more than when they are planted at a greater depth. This may be important in the South during the summer months.

The size of bulbs will vary considerably between varieties. Bulbs of some varieties will be small in size, others medium, large, and very large. There is also considerable variation in size of bulbs of the same variety. The type of bulbs that are generally sold as of blooming size is either "round" or "double nosed." The round bulbs have one growing point and the double nosed have two. The double nosed bulbs should produce more flowers. It is recommended that only the best quality bulbs be bought.

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FERTILIZER

The application of fertilizer is beneficial to most plants when it is needed and applied properly. A little more caution is needed in the use of fertilizer for daffodils than for many other flowering plants. This is because it has been found that available nitrogen intensifies the damage from basal rot, which is a very serious disease. Most gardeners use fertilizer rather freely because they want to encourage good plant growth. It is very likely that many daffodil bulbs have been lost from basal rot because of the excessive use of fertilizer. As yet no fertilizer experimental work has been done with daffodils at this Station. It is believed, however, that if there is a place for the use of bone meal in a garden, it should be used when fertilizing daffodils. It contains little nitrogen and what is present is in the organic form and slowly available to the plants. Bone meal contains no potash and the addition of potash may often be helpful. Well decomposed manure should also be beneficial. Commercial fertilizers that are low in nitrogen should be used if they can be obtained. If a fertilizer such as 8-8-8, which is not low in nitrogen, is used it should be applied at the rate of about 1 pound per 100 feet of row. Caution should be used in the application of fertilizer. It should be mixed well with the soil. When bulbs are left in place for two or more years it may be applied to the surface of the soil.

DURATION OF PLANTING

If bulbs do not rot, they should multiply, though the amount of increase will vary to some extent with the variety. This means that if a planting of daffodils is taken care of but not disturbed, there should be an increase in number of flowers from year to year. It also means that if left too long without separation there will be crowding. When bulbs are first set the space is not fully utilized. In general where daffodils are well adapted it is believed that the best flower production will be obtained the second year after planting. With most varieties this was not true at the Experiment Station, though with some varieties it was true. There were usually more blooms the second year but they were not as large. The third year there were still more blooms but generally smaller ones. Under conditions at the Experiment Station, bulbs of most varieties got smaller from year to year even if not crowded. Exceptionally large King Alfred bulbs were planted one fall and when dug the next summer only medium sized bulbs were produced. After staying in place for three years only small bulbs were obtained. The size of blooms produced for a given variety is dependent to a large extent on the bulb size. In general the larger the bulbs produced, the larger the flowers. It is believed that the bulbs should be dug and replanted at intervals of three years.

The best time to dig the bulbs is after the foliage has died down. Foliage should not be removed while it is still green. It is after the plant has flowered that the bulb size and bud initiation for the next year's flower is determined. If bulbs are not to be dug, the holes that are often left by dead foliage should be filled, for they may serve as an entry for insects to get to the bulbs. The bulbs should be replanted as soon as possible after they are dug. Bulbs should not be left exposed to the sun very long. If bulbs are to be kept for awhile before they are planted it should be in a cool, well ventilated place. Bulbs should not be stored in cold storage, especially at 40° F. Bulbs stored at 40° F. produced very early, very poor blooms and the plant growth was weak. Storage at about 40° F. hastens the time of flowering of several kinds of bulbs, but usually the size of plant and number and size of flowers are reduced.

DISEASES AND INSECTS

There are disease and insect problems with nearly any plant that is grown and the daffodil is no exception. The home gardener in general does very little about their control, for usually the bulbs are planted and weeds probably controlled and that is about all that

is done. A little effort expended on the control of insects and diseases would often be well worthwhile. The commercial grower must try to control insects and diseases if he is to be successful. If bulbs could be obtained that had been treated it would be a big help to home gardeners, as they usually will not do it themselves. The most serious disease of daffodils in this area is basal rot, which is caused by a fusarium. This disease probably accounts for most of the bulbs lost due to rot. There are other organisms, such as southern blight (*Sclerotium rolfsii*), that will cause bulbs to decay. Fusarium is a soil-borne organism. It is especially injurious at high temperatures, and that is one reason that it causes so much damage in south Louisiana. The more the available nitrogen present in the soil, the more likely the bulbs are to be damaged by basal rot. As has been mentioned before, there is some varietal difference in susceptibility to the organism. Only sound bulbs should be planted. There are a number of treatments that have been used to help control the disease, but only two will be mentioned here. One is to dip the bulbs for five minutes in a mixture of $\frac{1}{4}$ pound of "2 per cent Ceresan" in 2 gallons of water, then let dry and plant as quickly as possible. The other is to treat for five to ten minutes in a solution of $\frac{1}{8}$ ounce of P.M.A. (phenyl mercuric acetate) in 2 gallons of water. The material should be made into a paste with hot water and dissolved in water.

Another disease that is found on all the *Narcissus* group is mosaic. This is caused by a virus. Plants infected with this virus have leaves that are not clear green in color but are mottled or spotted. The whole plant contains the virus, and there is no control of the disease in the infected plants except to destroy them. It is probably spread by insects such as aphids. If they are controlled it will help prevent the spread of the disease. This disease is likely to be found rather generally. Plants with a mild form of the disease have been observed to live and flower very well in yards for years.

There are numerous other diseases that are important in commercial bulb producing areas but they will not be considered here.

There are not many serious insect pests of the daffodil that the home gardener is likely to have to contend with. There are two that will be mentioned. They are both chewing insects and may cause serious damage to the foliage usually rather late in the season. Such loss of foliage is injurious to the next year's plant. One of these insects is the zebra caterpillar, which is also very injurious to amaryllis. When small they can be found in compact

groups. They are voracious feeders and grow to be rather large "worms." If not controlled they can eat a lot of foliage in a relatively short time. In late spring, plants should be inspected frequently and the larvae destroyed as soon as possible after they are hatched. The longer the delay the more they will eat. The recommended control is to use a 5 per cent or 10 per cent D.D.T. dust, or spray with 1 ounce of 50 per cent D.D.T. wettable powder per gallon of water. If they are found when they are small and in rather compact groups, an easy method of control is to mash them by tramping on them.

Another insect that eats the foliage is the lubber which, when grown, develops into a very large black grasshopper. They also occur in groups and are heavy feeders. The smaller they are when they are destroyed, the less the damage to the plants. Chlordane used at the rate of 1 tablespoon of 50 per cent wettable or emulsifiable material per gallon of water should control these insects. Sometimes it is easier to mash them than to poison them.

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